ELECTRICAL REVIEW

ILLUSTRATED.

A WEEKLY JOURNAL OF

Electric Light, Power, Telephone, Telegraph and Scientific Progress.

VOL. 17, No. 22. WEEKLY. | NEW YORK, SATURDAY, JANUARY 24, 1891. | $3 per annum. Single Copies, 10 Cents.

Copyright, 1891, by Electrical Review Publishing Company, 13 Park Row, New York.

Entered at Post Office, New York, as Mail Matter of the Second Class.

VIEWS, NEWS AND INTERVIEWS.

Emma Abbott, the famous opera singer, whose death recently occurred, left instructions in her will that her body be cremated after a thorough test by electricity. It is said that Miss Abbott had a great fear of being buried alive.

Mayor Grant spent several days in Boston last week. It is said he went over to inspect the overhead electric railway system as operated by the West End Street Railway Company. Well?

The late Dr. Joule, of Manchester, England, was a welcome, if occasional, visitor to Sir William Thomson, they being old friends, and the story is told by one of our English contemporaries that at the period when Sir William was bringing out his sounding machine, in which steel wire takes the place of the ordinary lead line, he showed Dr. Joule a bundle of pianoforte wire, telling him at the same time that it was for "sounding." "What note?" inquired Dr. Joule, not quite understanding. "The deep C," promptly replied Sir William.

A little reflection will convince any one that life is incomparably easier to live than it was 50 years ago. Almost all the great electrical inventions have been brought into daily use within the lifetime of you who are not yet middle aged. Invention in other fields has enjoyed rapid progress. Let's thank the men who make it easier for us to live. Who are they? The inventors—commonly known as "cranks."

What is probably the best portrait extant of Noah Webster, the famous maker of the "Unabridged," was painted by Professor S. F. B. Morse, the inventor of the telegraph. It is not generally known that Prof. Morse was an artist of undisputed talent and ability.

Mr. Erastus Wiman has an article in the current number of the *North American Review*. He delivered a lecture recently before the Brooklyn Union League Club. Mr. Wiman is vice-president of the New York Electric Club, in which he takes a deep interest.

Mr. J. R. McKee, the son-in-law of President Harrison, will in the future make Boston his home. Mr. McKee has taken an interest in the Thomson-Van Depoele Electric Mining Company, and will assume its management.

A Pittsburgh student while reading the book of the Vision of Nahum, the Elkashite, came across a passage that seemed to him to be a prophecy of the discovery of the use of electricity as a motive power in the electric railways of the present day. The passage is from Nahum II, 4, and reads as follows:

"The chariots shall rage in the streets, they shall jostle one against another in the broadways; they shall seem like torches; they shall run like the lightnings."

Private advices from Brazil are to the effect that crude rubber has advanced two cents a pound and that Baron Vianna, of the Brazilian rubber syndicate, is buying all he can at that price. Evidently, the Baron looks for a further rise in rubber.

The Rapid Transit Question.

About 100 interested persons assembled in Steinway Hall, New York, January 16, at the invitation of the Rapid Transit Commission, to discuss the problem of, and present ideas on, quicker means of transportation for the people of New York. A number of cranks were in attendance but were quickly disposed of.

Mr. Louis Sterne, a civil engineer of London, representing the Greathead system of underground electric railroad, explained his system as used on the recently opened London and Southwark underground road. A hasty computation of the probable cost of an underground railroad system in New York city assured Mr. Sterne that a double-tunnel system could be constructed for less than $1,000,000 a mile, and a four-track system—if constructed at the same time—for less than $1,800,000 a mile, including equipments and organization. Such a system of railroad for New York city could be more speedily constructed than any other, and, when completed, would give to the city a greater measure of relief from the present overcrowded condition of its surface and elevated railroad lines and would assist more materially in the development of the unsettled sections of the city than any other system.

Several schemes for elevated and aqueduct roads were presented, more or less in detail. A representative of an English cable railway company presented his system for consideration. Robert R. Hazard entered an appearance for the New York Underground Railroad, and asked that its engineers be heard at a subsequent meeting. That concern, he said, was a relic of the past, but it hoped to see its route and plan adopted, namely, an underground electric road under Broadway.

Another meeting for further discussion of the subject will be held at the same place at 3 P. M. Thursday of this week.

Electric Lighting in California.

While enumerating some of the principal institutions of San Diego, Cal., the San Diego *Union* has this to say about the electric light system of the city:

The incandescent system of electric lighting was introduced about two years ago by the Electric Rapid Transit Street Car Company, George D. Copeland, president, and has become an assured success under his management, reducing the rates of commercial and domestic lighting beyond any which ever before prevailed in this city. In fact the rates for gas and electric lights are now lower in San Diego than those prevailing in other towns on the Pacific coast, where steam power is used, and should the project to use the water-power at the end of the flume materialize, still further reduction in rates may be expected.

The present Copeland plant consists of two Westinghouse alternating current incandescent dynamos of a capacity of 750 sixteen candle-power lamps each, including exciters, switchboards and electrical instruments. The dynamos are run by steam power, and so complete are all the operations of the system that there has been no interruption in the regular business of light distribution during the past year. This plant was established at the close of the "boom" period, and many predicted that the effort to establish the business in the face of the opposition of the old established and wealthy gas company, and during a time of much financial depression as has prevailed during the past two years, would be a failure. Under the economical management, however, of Mr. Copeland the enterprise has become one of the permanent and successful institutions of the city.

A New Fire Alarm.

A Danish inventor has devised a novel fire alarm. It consists of a small copper cartridge closed in by an india-rubber button and filled with a colored fire composition. The fuse consists of a mixture of potassium chlorate and sugar, and on it is placed a paraffin capsule containing a few drops of strong sulphuric acid. When the temperature of the room rises above the melting point of paraffin, the sulphuric acid is liberated and ignites the chlorate mixture, which, in its turn, sets fire to the Bengal light. A fusible metal disk placed in contact with this mixture will also be melted, and thus make electrical connection with a call bell, so as to sound the alarm at a distance.

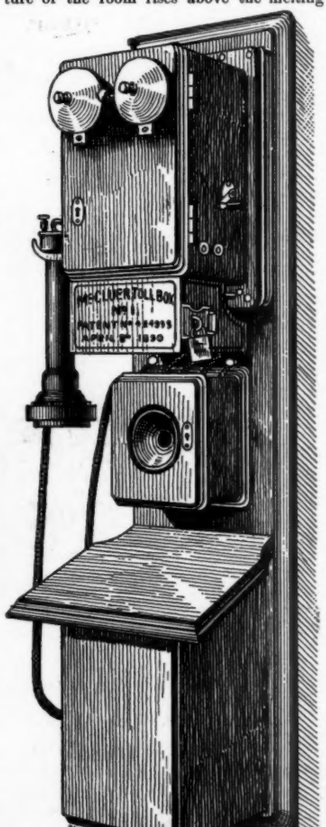


Fig. 1.—Telephone Set With McCluer Toll Device.

What Caused the Delay.

"Great Scott!" exclaimed one employé in the telegraph office to another, "haven't you sent that message yet?"

"No," replied the operator, "there is something written down on one corner of the page that I couldn't quite catch, so I put it aside till I got time to study it over. Can you make it out?"

"Yes; I wrote it myself. It's 'Rush.'"
—*Washington Post.*

TELEPHONE PROGRESS.

The McCluer Telephone Toll-Box and Connection Register.

The near approach of July, 1893, a month of paramount interest to the telephonic fraternity, is heralded by the advent of a numerous array of devices intended to provide for the ready substitution of telephone "toll" systems for the "fixed" rental systems now almost universally in vogue. As long as the telephone companies possess the rights conferred upon them by the operation of our domestic patent laws, they are able to establish and maintain fixed rates for specified terms, which are sufficiently lucrative to enable them to stand the imposition practiced upon them by non-subscribers; but, upon the expiration of the fundamental telephone patent granted to Professor Bell in 1876, it is highly probable that the rates now charged for telephone service will be materially reduced. As the margin between receipts and expenditures becomes narrowed by the reduction of rates, followed by increased patronage and the usual disproportionate increase in operating expenses, the illegal use of subscribers' telephones by non-subscribers will become a burden too grievous to be longer borne by the patient and long suffering telephonist, and resort will necessarily be had to some system more equitable in its operation than the fixed rental system. The toll system will then, undoubtedly, come to the front, and the telephone companies will very probably be compelled to adopt such a system in self-defense.

Besides, a "toll" system is the only equitable method of dispensing telephone service. Under the fixed rental systems, *A*, who really has but little use for his telephones, pays as heavily for his moderate service as does *B* whose telephones are utilized a hundred times a day. The telephone company, therefore, as the cost of the service is proportionate, not to the amounts charged *A* and *B*, respectively, but to the amount of service, rendered each of them, loses money on *B*'s subscription, which they must make up from *A*. *A*, therefore, besides paying a disproportionate rate for his moderate use of the telephone system must also pay for *B*'s immoderate use of his telephones. This unjust discrimination can only be remedied by the adoption of a "toll" system.

A toll system, however, to be satisfactory to the telephone company and its patrons alike, must be accompanied by checks and safeguards designed to protect the interests of both parties. The central office records of connections are unsatisfactory to the subscriber, who is apt to consider his bill for service rendered excessive. He is also inclined to err in his own favor if his record is relied upon, and a toll-station agent is prone to be careless and indifferent to the company's interests, and favor his friends and business customers with frequent free telephonic conversations. Hence, a device for automatically registering or recording connections, that is reliable and unfailing in its operation, that can be economically applied and maintained, and which furnishes a record of connections that the telephonist and his patron can alike unhesitatingly accept as correct—becomes a desideratum.

A device that seems to fully meet all these

requirements has been recently patented by Mr. C. E. McCluer, an experienced telephonist of Richmond, Va., which we describe below:

Fig. 1 is an exterior view of an existing

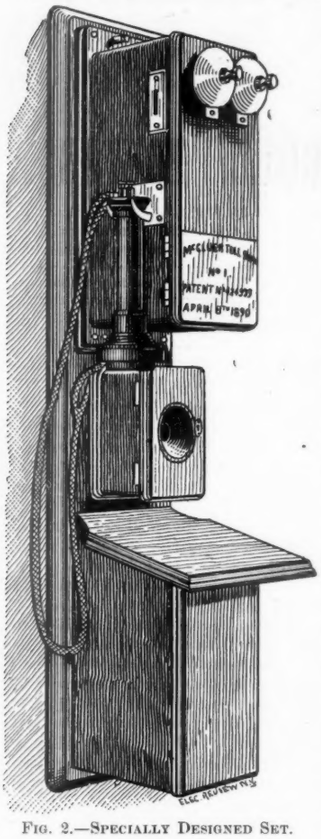


FIG. 2.—SPECIALLY DESIGNED SET.

magneto to which the "toll" device has been applied. There is ample space in the ordinary magneto for the introduction of the automatic device proper, but the addition of a special receptacle for the coins or tokens becomes necessary. This addition is made without any detriment whatever to the appearance or efficiency of the magneto.

Fig. 2 represents the exterior of a specially designed magneto, the box being simply lengthened a few inches to provide for the money till.

Figs. 3 and 4 are intended to represent the interior construction of the toll device, the various parts being lettered alike on each figure. *A* is a flat tube the internal diameter of which is designed to allow the ready passage through it of a coin or token admitted by the escutcheon *B*. The tube *A* and escutcheon *B* are securely held in place by the bolts and nuts *H*, the various sizes of escutcheons being interchangeable. Therefore, a box can be readily operated by any desired coin, by simply substituting one escutcheon for another, and re-adjusting the stationary electrode as explained below.

C is a back-stop, which operates through the apertures *F*, and whose function it is to prevent the toll taking device from being operated in an illegitimate manner.

D is a normally stationary contact point, but which admits of adjustment to suit different sizes of coins or tokens. *E* is a movable contact or electrode, mechanically attached to, but electrically insulated from the phone-hook *G*, in such a manner, that, when the phone-hook is depressed by the weight of the hand-phone, as represented in Fig. 3, it will, in conjunction with stationary contact *D*, arrest the coin on its way into the till, and hold it suspended against and, of course, in electrical contact with, both electrodes. As soon, however, as the phone is removed from the hook, and the hook is raised, by its retractile spring, into the position shown in No. 4, the space between the two electrodes *D* and *E* is increased sufficiently to allow the coin to escape and fall into the till.

It will now be readily understood that the electrodes *D* and *E* are the terminals of a break or opening in the magneto-generator circuit, which is closed by the metallic coin or token electrically bridging the space between them. In this condition the magneto-generator will operate as normally and the central office or another station can be rung up. The act of removing the phone from the hook, as is necessary before the telephones can be utilized for a conversation, automatically releases the coin or token and allows it to drop into the till, thus opening the generator circuit. Before another call can be made from the same magneto, another coin must, therefore, be introduced into the tube. Hence a coin or its equivalent must be found in the till for every connection, the number of coins indicating unerringly the number of connections ordered through the toll box.

The door of the box *J* is first closed, and then the door of the till *I* is closed and locked, a rabbit on the latter engaging with a reversed rabbit on the former and preventing it from being opened unless the door of the till is first unlocked and opened, the one lock *L* serving to secure both doors, and preventing unauthorized access to the toll device unless the till door is first forced, which would render the individual committing the act amenable to a charge of felony.

The escutcheons, tubes and contacts can be adjusted for coins of the various denominations, or for special metallic tokens, as may be deemed preferable. The tokens can be sold to customers at rates scaled according to the quantity purchased, or they can be merely used as connection recorders by regular subscribers, to whom bills would be rendered at stated intervals, at rates dependent upon the total number of connections ordered, as indicated by the number of tokens found in the till.

Many of these toll-boxes could undoubtedly be utilized in exchanges now operated under the fixed rental systems, with advantage to the community and profit to the telephone companies. An adequate number of stations judiciously located with reference to the needs of the general public, and furnished with automatic toll boxes, would enable the advantages of the exchange service to be availed of legitimately by the entire community, and thus do much to correct the imposition to which telephone companies are now subjected in the liberal use of the exchange systems by non-subscribers without compensation.

An exchange system being thus thrown open to the legitimate use of an entire community through the medium of the toll stations, would undoubtedly have the effect of increasing the number of fixed rental subscribers, thus further swelling the income of the telephone company. Many business men and trades people who do not become subscribers because but few, if any, exchange subscribers are numbered among their patrons, would soon be compelled to provide telephones of their own or see the trade of their non-subscriber patrons diverted to their more enterprising competitors through the medium of the toll stations.

The use of the automatic toll boxes also renders possible the introduction of pony exchange systems in towns and villages not large enough to support a regular fixed rental exchange—a few toll stations judiciously located, serving the entire community and bringing in a larger revenue than could be derived from a small number of fixed rental subscribers—although as many fixed rental stations as might be demanded could readily be operated in connection with the toll stations.

The simplicity of Mr. McCluer's device, its ready and economical application to existing magnetos, its reliability and certainty of operation, its compactness, and its location inside of the ordinary magneto box, where it cannot be cut-out of circuit or its operation evaded in any way by expert electricians even, coupled with its ready adaptability to all conditions of exchange or branch line service, and the very important fact that it is entirely automatic in its operation, thus relieving the telephone operator from all responsibility, should commend it to the favorable consideration of all telephone companies.

Mr. C. E. McCluer (Richmond, Va., P. O. Box 32) will cheerfully furnish correspondents all further particulars concerning this invention.

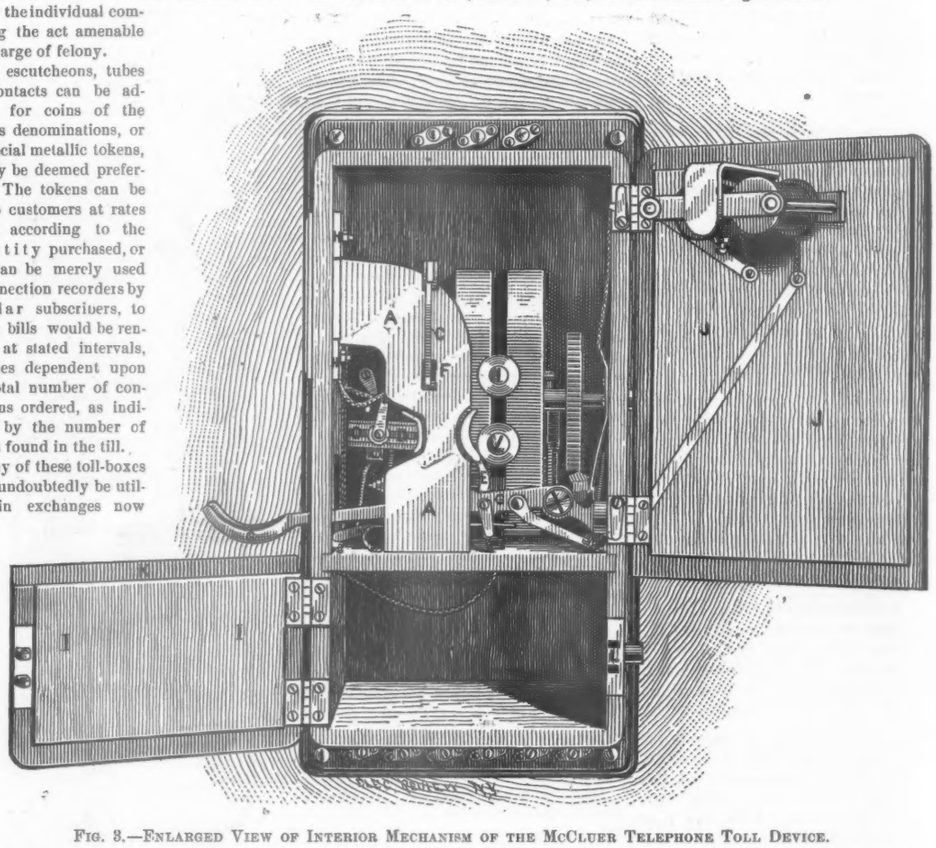


FIG. 3.—ENLARGED VIEW OF INTERIOR MECHANISM OF THE McCLUER TELEPHONE TOLL DEVICE.

For several nights the electricians have been experimenting with the novel and very beautiful electric clock in the tower of the Penn Mutual Life Insurance Company's building, Philadelphia. The latest effect tried is the combination of colored with white lights. At the great height at which the clock is situated it is said that the effect of the colored lights is lost.

The town of Bloomsburg, Pa., is soon to be lighted by electricity. The Bloomsburg Electric Light and Power Company has been incorporated, with a capital stock of $25,000, with W. R. Tubbs, president; L. E. Waller, Jr., secretary, and Dr. I. W. Willits, treasurer. A complete arc and incandescent plant is being put in by the Thomson-Houston Electric Company. Under the management of Mr. Daniel Killian, the plant is being rapidly completed and it is expected the current will be turned on by March 1st.

Massachusetts Towns may not Maintain Electric Lighting Plants.

The full bench for the supreme court of the Commonwealth of Massachusetts has ordered a decree for the petitioners in the case of Willard Spaulding *vs.* the town of Peabody, and makes perpetual an injunction to restrain the town from contracting and maintaining an electric lighting plant. The court says:

"We assume, for the reasons stated in the opinion given by the justices of this court to the House of Representatives on May 27th, 1890, 150 Massachusetts, 592, that the legislature by statute can confer upon towns authority to construct and maintain works for the manufacture and distribution of electricity to be used by the towns and their inhabitants for illuminating purposes. The question was presented as to whether the existing statutes confer any such authority, either for the purpose of lighting the streets of towns, or for this and the additional purpose of furnishing light to their inhabitants at reasonable rates. Such authority is not within any of the customary powers which towns from very early times have exercised, and must be derived, if it exists, from the statutes relating to towns.

"The subject of constructing and maintaining gas or electric works for the manufacturing of gas or electricity and the distribution of them through the streets of towns and cities for the purpose of furnishing light is one of too much importance to be attached as a mere incident to the power given to erect and maintain street lamps, and we think that if the legislature had intended that towns generally should have authority to erect and maintain such works, the authority would have been plainly expressed in the statutes, with such limitations and accompanied by such restrictions as the legislature might think it proper to exercise. We see no indications in the existing statutes that the legislature intended to make provision for the exercise of any such authority by the towns of this Commonwealth. If we assume that the only action now contemplated by the town of Peabody is the erection and maintenance of electric works for the purpose of lighting its streets, in the manner shown by the evidence, still we are of opinion that the vote is beyond the legal right and power of the town."

The Edison Electric Light Company, of West Chester, Pa., has declared a dividend of 5 per cent., payable on the 2d of March next.

Experiments on the Variation of Conductivity Under Different Electrical Influences.

At a meeting of the Paris Academy of Sciences, held on Nov. 24, Monsieur Edouard Branly read a paper, in which he described some experiments upon the variations of conductivity observed in their metallic layers when subjected to electrical influences.

The layers of metal were prepared by spreading metallic dust upon a plate of ground glass or ebonite of dimensions 7 cm. × 2 cm., and then polishing with a burnisher. In the case of copper, a little tin was added to facilitate adherence. Such a layer is capable of a resistance which may vary from several ohms to several millions for the same weight of metal.

If a circuit be formed containing one of these prepared layers, a high resistance galvanometer, and a Daniell cell, only a very insignificant current is able to pass. An abrupt diminution of resistance, accompanied by a marked deviation on the galvanometer, is exhibited when electric discharges are produced in the neighborhood of the circuit by the action of a small Wimshurst machine or a Ruhmkorff coil. This effect diminishes when the distance of the losses of discharge is increased; but it is easily observed, without special precautions, when the distance is increased to several metres. By making use of a Wheatstone's bridge, it has been observed when the distance has been 20 metres.

Besides the behavior of a thin layer of copper, that of similar layers of iron, aluminium, antimony, cadmium, zinc, bismuth, and several other metals were examined.

Check experiments were devised by Branly, and carried out, in which a capillary electro-meter played an important part; but the results were in every respect confirmed.

Branly has examined the condition necessary to produce the observed phenomena, and with the following results:

It is not necessary that the circuit be closed, but the diminution of resistance is best produced if the metallic layer is bound by its extremities to the conducting wires.

The passage of an induced current through the layer produces the same effect as that of a discharge in its neighborhood.

When working with continuous currents, the passage of a strong current renders the metallic layer better able to transmit a full current.

The best results were obtained when, in these experiments, were substituted for the plate of glass and ebonite covered with metallic layers, what Mr. Branly calls "tubes à limailles," that is, tubes of glass or ebonite which have been treated with fine metallic filings mixed with some non-conducting liquid.

New Method of Photographing.

A method of taking photographs by means of electro-magnetism is reported from Vienna by the correspondents of some newspapers, but details are missing. Meantime, the following may be of interest: A new method of photography is described in the *Photographische Archiven*. It is based on the fact that yellow phosphorus, dissolved in carbon bisulphide, is converted by the action of light into red allotropic phosphorus, which is insoluble in that liquid. A solution of the yellow variety is poured over a glass plate or a lithographic stone and allowed to dry in the dark. It is then exposed to the light under a negative photograph for half an hour, when a feeble red image is produced. Any unchanged phosphorous is now washed away with carbon bisulphide. Copper or silver images can be obtained from the red picture by immersing the plate in a solution of copper sulphate or silver nitrate to let the phosphorus reduce the salt. Paper moistened with these solutions takes a print of the picture when pressed upon the plate. That does not seem to be a very attractive process to the average amateur.

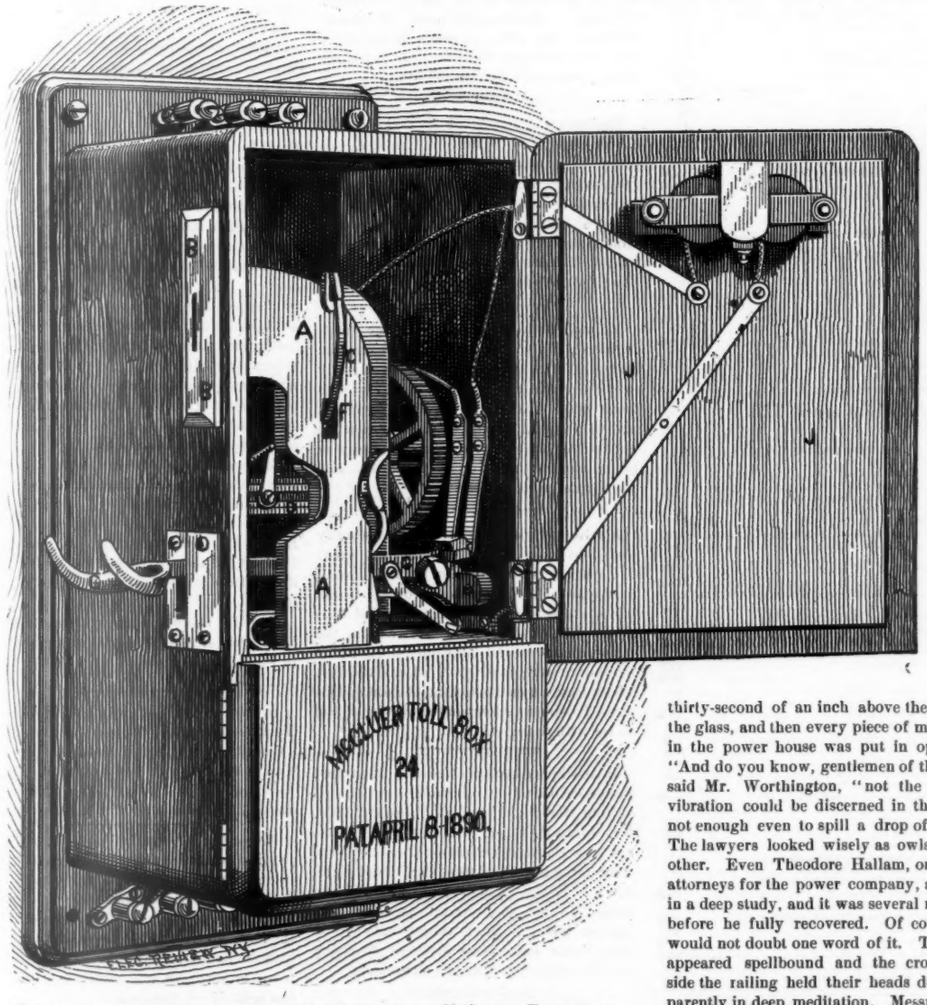


FIG. 4.—ANOTHER ENLARGED INTERIOR VIEW OF THE McCLUER TELEPHONE TOLL DEVICE.

The Power House did not Vibrate.

Alexander Worthington, vice-president of the Covington, Ky., Electric Light and Power Company, made the following remarkable statement in the circuit court at that place one day last week. The question at issue is the case of Dr. Wise against the electric light company for alleged damages to his property on Fourth street by reason of the constant shaking caused by the running machinery in the power house, about 100 feet distant from the doctor's residence. Worthington testified that he placed a glass tumbler on a table in the power house and poured the glass full of water. He then dropped a number of bird shot into the glass to bring the water up to the brim. To make sure that the glass was full, he placed a rule across the top, and upon removing it the bottom was found to be wet, which was a sure indication that the glass was full. He next dropped 700 bird shot into the glass, which, he stated, brought the water a full thirty-second of an inch above the brim of the glass, and then every piece of machinery in the power house was put in operation. "And do you know, gentlemen of the jury," said Mr. Worthington, "not the slightest vibration could be discerned in that glass, not enough even to spill a drop of water." The lawyers looked wisely as owls at each other. Even Theodore Hallam, one of the attorneys for the power company, appeared in a deep study, and it was several moments before he fully recovered. Of course, he would not doubt one word of it. The court appeared spellbound and the crowd outside the railing held their heads down, apparently in deep meditation. Messrs. C. H. Weeks and E. W. Babcock, mechanical experts, of Cincinnati, and president of the company John R. Coppin, testified to being present when the experiment was made, and they corroborated the testimony of Mr. Worthington. This case is attracting more than ordinary attention. It is still in progress.

Edison Improvements at Schenectady.

The architects have completed the plans for four new buildings for the Edison Machine Works at Schenectady, N. Y. The new building will be in the shape of a letter "L" and will be three stories high. The main portion will be 324 feet long and the "L" part 228 feet long. Work will be begun as soon as weather permits. When the buildings already begun and this large one are finished, the aggregate floor capacity of the whole establishment, it is claimed, will exceed that of any other manufacturing institution in the country.

Springfield, Mass.—Springfield Electric Company; capital, $15,000.

Chicago, Ill.—The Bushnell Electric Company; capital, $25,000; to furnish electric light.

Louisiana, Mo.—Louisiana Electric Company, of Louisiana, Pike County; capital, $6,000.

Portland, Me.—American Electric Machinery Company; capital $10,000. D. W. Scribney, president; S. L. Moody, treasurer.

Marlboro, Mass.—Germania Electric Company, to manufacture the Schaefer incandescent lamp and electrical supplies; capital, $250,000.

Bridgeport, Conn.—Union Electric Manufacturing Company has been formed by J. M. Orford and H. T. Clark, of Bridgeport, and several New York parties.

Sacramento, Cal.—Redding Electric Light and Power Company; capital, $50,000. Directors: Francis Smith, Rud M. Sallitzer, S. P. Fillmore, S. J. R. Gilbert and W. W. Williams.

Chicago, Ill.—The Bain Electric Manufacturing Company; capital, $250,000; to manufacture and operate electric machinery. Incorporators: Foree Bain, M. F. Allen and B. S. Gray.

Colorado Springs, Col.—The Pecos Valley Telegraph Company; capital $50,000. Incorporators: J. G. Hagerman, H. C. Lowe, T. H. Esdall. The company will operate in the Pecos Valley, in New Mexico and Texas.

Sterling, Kan.—The Sterling and Lyons Electric Railroad Company; capital, $50,000. Directors: H. M. Maxwell, P. Hockett, J. A. Hockett, John H. Ricksecker, Sterling; A. Hones, A. W. Hoyt, J. A. Blair, Lyons.

Santa Fe, N. M.—H. G. Wolff, F. L. Rohfing, William Deutch and others are directors in a company incorporated with $1,000,000 capital, to supply Santa Fe with rapid transit, electric light, telephone service and water and health resorts.

Oregon, Ill.—The Oregon Water and Electric Power Company, of Oregon, Ogle County, Ill.; capital, $100,000; for the construction and maintenance in Rock River of Illinois of dams for water power, and the generation of electric currents therefrom and the distribution and sale of electric energy for power and other purposes. Incorporators: Charles W. Raymond, W. A. Shepard and L. M. Rose.

And Still They Come.—Thanks.

Ziegler Brothers, 73 Federal street, Boston, makers of electrical and mechanical instruments, have sent us a tastefully engraved calendar, printed in blue-black ink on a buff card.

R. T. White, 12 Pearl street, Boston, sent an indestructible linen calendar showing his patented materials for street railway construction.

The Ashton Valve Company, 271 Franklin street, Boston, sent one of the handsomest steel engraved calendars we have received.

Styles & Cash, printers, 77 Eighth avenue, New York, presented us with a very artistic and novel calendar. The color scheme is especially charming. A clock hand is used to keep tab on the days as they slide by.

The Central Electric Company, 116 and 118 Franklin street, Chicago, sent a large calendar with a handsome heading. The firm's name and business are set forth in zigzag lightning flashes. Okonite is prominently mentioned.

ELECTRICAL REVIEW

Published at 13 Park Row,

P. O. Box 3329. NEW YORK.

EDITORS:

GEO. WORTHINGTON. CHAS. W. PRICE.

ASSOCIATE EDITORS:

ROBT. H. READ. STEPHEN L. COLES.

BUSINESS STAFF:

GEO. WORTHINGTON, *President.* CHAS. W. PRICE, *Secretary.*

ROBT. H. READ, *Manager Patent Bureau.*

H. T. RICHARDS, *Mgr. Advertising Department.*

REGISTERED CABLE ADDRESS:

"ELECTVIEW," NEW YORK.

"1546 CORTLANDT," TELEPHONE CALL.

BOSTON OFFICE:

W. I. BARKER, Room 29, 620 Atlantic Ave.

WASHINGTON OFFICE:

GEO. C. MAYNARD, 1409 New York Ave.

CHICAGO OFFICE:

D. B. DEAN, 163 Randolph Street.

EUROPEAN OFFICE:

CHARLES FFRENCH, Editor for Europe.

HOTEL VICTORIA,

Northumberland Ave., Charing Cross, London, W. C.

Cable Address: - - "Electview," London.

Telegraphic Address: Ffrench, "Victorioa," London.

SUBSCRIPTION TO THE ELECTRICAL REVIEW.

One Year, United States and Canada, - $3.00

One Year, Foreign Countries, - - 5.00

Single Copy, - - - - .10

ANNOUNCEMENT.

Address all communications and make all money orders and checks payable to order of ELECTRICAL REVIEW, P. O. Box 3329, New York.

No attention will be paid to communications for the REVIEW without the *name and address of the writer.*

NEW YORK, JAN. 24, 1891.

CONTENTS.

PAGE.

Views, News and Interviews ... 259
The Rapid Transit Question ... 259
Electric Lighting in California ... 259
A New Fire Alarm ... 259
What Caused the Delay ... 259
Telephone Progress ... 259
Massachusetts Towns may not Maintain Electric Lighting Plants ... 260
Experiments on the Variation of Conductivity Under Different Electrical Influences ... 261
New Method of Photographing ... 261
The Power House did not Vibrate ... 261
Edison Improvements at Schenectady ... 261
New Corporations ... 261
And Still They Come.—Thanks ... 261
Benjamin Franklin ... 262
Correspondence:
Our Washington Letter ... 263
Our Boston Letter ... 263
Our Chicago Letter ... 263
Our Albany Letter ... 263
Our St. Louis Letter ... 263
Telephonic News ... 264
The City that has the Columbus Fair ... 264
The Bell Patent ... 264
Glass Insulators ... 264
An Old Telephone Switchboard ... 264
Wooed by Wire ... 264
Electric Railway Fight in Philadelphia ... 264
Management of Electric Light Plants on War Vessels ... 264
Frey Portable Reflecting Galvanometer ... 265
The Electric Car Cure ... 265
Personal ... 265
Telegraphic ... 265
The Postal Telegraph Bill Pleases Wanamaker ... 265
Electric Power ... 266
Electrical News from Kansas City ... 266
Types of Electro-Magnets ... 266
Researches on Secondary Batteries ... 266
The Wenstrom Company ... 267
Plant Efficiency with Hedgehog Transformer ... 267
The Rise of Potential Difference in the Deptford Mains ... 267
Thomson-Houston and Brush Representatives Meet in Cleveland ... 267
Electric Light News ... 267
Progressive Electrical Inventions ... 268
Electrical Visual Indicators or Sporting Bulletins ... 268
The Electrical Railway Between Vienna and Buda-Pesth ... 269
Electrical Stage Effects ... 269
Phase Indicator ... 269
Electric Clubs:
New York Electric Club ... 269
Harvard Electric Club ... 269
Book Notices ... 269
Kindred Interests ... 270
A True Statement About Advertising ... 270
Financial ... 270
Electrical Patents ... 270

INDEX OF ADVERTISERS.

COVER PAGES. PAGE.

Ansonia Brass & Copper Co ... xxiv
Armington & Sims ... xxiv
Bridgeport Brass Co ... xxiv
Brush Electric Co ... xxiii
Davis, Charles H., Electrical Engineer ... xxiv
Day's Kerite Insulated Wires ... xxiv
Eastern Electric Cable Co ... xxiv
Edison General Electric Co ... ii
Hampson & Co., E. P ... xxiv
Jewell Belting Co ... xxiv
Moore, Alfred F ... xxiv
Okonite Co ... xxiv
Simplex Electrical Co ... xxiv
Standard Underground Cable Co ... xxiv
Tucker Electrical Construction Co ... xxiv
Wilmot & Hobbs Manufacturing Co., The ... xxiv

INSIDE PAGES.

Accumulator Co ... xxii
Alexander, Barney & Chapin ... iv
American Bell Telephone Co ... xv
American Circular Loom Co ... vii
American Electrical Works ... xiii
Baker & Co ... xviii
Ball Electric Light Co ... xv
Barnes Co., W. F. & John ... vi
Baxter, H. E. & C ... xvii
Berlin Iron Bridge Co ... iii
Bernstein Electric Co ... vii
Brownlee & Co ... viii
Bubier Publishing Co ... xvi
Buckeye Engine Co ... xx
Burton Electric Co ... xvii
"C. & C." Electric Motor Co ... vii
Central Electric Co ... iv
Chadbourne, Hazelton & Co ... xviii
Clark Electric Co ... iv
Consolidated Electric Storage Co., The ... vi
Crocker-Wheeler Motor Co ... xx
Crosby Electric Co ... xii
Detroit Electrical Works ... iii
Dwight Slate Machine Co ... xvii
Edson, J. B ... 270
Elektron Mfg. Co ... xi
Empire China Works ... xx
Empire City Electric Co ... iii
Evans Friction Cone Co ... xv
Eureka Tempered Copper Co ... xxi
Faraday Carbon Co ... xvii
Field Engineering Co ... xxi
Fletcher & Fletcher Electric Co ... xviii
Fort Wayne Electric Co ... xxii
For Sale—Glow Lamp Patent ... xiii
Garvin Machine Co ... vi
Gate City Electric Co ... ix
Goodyear Hard Rubber Co ... ix
Gordon & Co., W. H ... xvii
Greeley & Co., The E. S ... xvii & xxi
Haasenstein & Vogeler ... xiii
Heine Safety Boiler Co ... vi
Holmes, Booth & Haydens ... xiv
Holtzer-Cabot Electric Co ... iv
Industries ... xviii
Independent Bung Co ... xiv
International Aluminum Works ... xviii
Interior Conduit & Insulation Co ... vi
Lane & Bodley Co ... xvii
Law Telephone Co ... 270
Leclanche Battery Co ... xiii
Leffel & Co., James ... xvii
Lehigh Valley Creosoting Co ... xvi
Maguire, F. Z ... xiii
Marshall, Wm ... xvi
McCreary Electrical Specialty Co ... xx
Nassau Electrical Co ... xiv
National Carbon Co ... vii
National Electric Mfg. Co ... viii
National Electrical Mfg. Co ... xxii
National Pipe Bending Co ... vi
New England Butt Co ... iv
New York Belting and Packing Co ... xvii
Noye Mfg. Co., John T ... iv
Otis Bros. & Co ... iv
Ostrander & Co., W. R ... xvii
Paiste, H. T ... 270
Parker-Russell Mining and Manufacturing Co ... xvii
Phœnix Glass Co ... xiii
Phosphor-Bronze Smelting Co., Ltd ... xv
Pond Engineering Co ... vi
Queen & Co., James W ... xiii
Ridlon & Co ... 270
Royce & Marean ... xvii
Santley & Co., W. R ... xviii
Sawyer-Man Electric Co ... xx
Schieren & Co., Chas. A ... 270
Schuyler Electric Co ... xviii
Sessions Foundry Co ... xx
Shaw & Co., J. Elliot ... xiii
Shultz Belting Co ... xvi
Sigourney Tool Co ... xvi
Simplex Electrical Co ... xiii
Southern Electrical Supply Co ... xiv
Standard Electric Supply Co ... xxii
Standard Paint Co ... vi
Stanley & Hall ... xvi
Star Electrix Co ... 270
Thomson-Houston Electric Co ... v
Tropical American Telephone Co ... xiv
United Electric Traction Co ... ix
United States Electric Lighting Co ... xvi
Universal Arc Lamp Co ... xviii
Vincent & Co., Charles R ... vi
Washburn & Moen Manufacturing Co ... xvii
Watson & Stillman ... xvi
Western Electric Co ... xvii
Whipple Co., Fred H ... xxi
Williams & Potter ... vi
Wyckoff, Seamans & Benedict ... 270

Several social functions will be held by prominent Providence electrical men during the National Electric Light Association convention meetings in February.

We notice in several contributions to recent issues of the English electrical journals that "henry" is being generally accepted as the name for the unit of inductance.

The decision of the Supreme Court against municipal ownership, in Massachusetts, of gas and electric lighting plants has been a severe set-back to the apostles of Nationalism. Special legislation on the subject will probably be the next matter to receive their attention.

It would be well if every electrical man who takes an interest in the science preserved all models and methods which may come into his possession. In twenty-five years the value of such things will be more than nominal. Several gentlemen have already accumulated collections of considerable merit.

You had better go to the Providence convention in February. It will be a great one. You cannot afford to miss it.

Inquiries are made why no appointment is made to fill the vacancy caused by the death of Commissioner Gibbens of the Board of Electrical Control. We would like to see an electrical engineer of standing and force appointed. Will it be done?

We call attention to our illustrated article in this issue on the McCluer toll device for telephones. It is a novel and interesting invention, and its adoption at some future time ought to prove a mutual benefit to both the subscriber and telephone company. It is designed for this purpose.

How that old telephone switchboard, described and illustrated on another page of the REVIEW, will bring up memories of long ago in the minds of the early telephone workers! Messrs. Gilliland, Williams, Chinnock and other pioneers in this field could tell a thing or two about the vexations and successes of before the eighties.

The first of a course of evening lectures on electricity, by Francis B. Crocker, was given at Columbia College, January 15. The great interest in the course is shown by the fact that tickets for the whole seating capacity of the hall were sold, and over twenty applicants were unable to be accommodated. President Low and Dr. Chandler both bought tickets for the course.

We are confident that Mr. George Westinghouse, Jr., will be able to overcome the financial difficulties that the scarcity of ready money in this country has caused to confront him. His efforts deserve success—and with our knowledge of the situation we predict that he will win in this instance as he has won with his many progressive and worthy enterprises in the past.

A sleet storm of considerable severity coated overhead wires with ice last week. Telegraphic communication with the South was retarded for some hours, owing to the wires giving way under their unusual burden. The underground service in the metropolitan district prevented delay in delivering messages in New York and vicinity. The splendid construction of the Long Distance Telephone Company came out of the storm with flying colors.

In another part of this issue is illustrated and described an old telephone switchboard used in Meriden, Conn., in February, 1878. Mr. Morris F. Tyler, president of the Southern New England Telephone Company, has written the history of this relic. Just think of it! Events which happened thirteen years ago we now record as interesting ancient history. Such things only go to show what marvellous progress telephony and the other electrical arts have made.

The Patent Celebration committees have opened offices at No. 811 G street, opposite the office of the Commissioner of Patents, and Secretary Watkins will be pleased to receive calls there from any person interested in the movement. The following named gentlemen have accepted invitations to deliver addresses relating to subjects on which they are recognized as authority: Prof. R. H. Thurston, of Cornell University, Senator John W. Daniel, of Virginia, Congressman Benjamin Butterworth, of Ohio, Commissioner Charles Eliot Mitchell, Hon. A. R. Spofford, Librarian of Congress; Hon. Edwin Willetts, assistant Secretary of Agriculture; Hon. Carroll D. Wright, Commissioner of Labor; Edward Atkinson, of Massachusetts, Col. F. A. Seely, of the Patent Office, Prof. Otis T. Mason, of Virginia, and Prof. F. W. Clarke, of Ohio. Dr. J. W. Toner, of Washington, will deliver a short address at Mount Vernon, upon "Washington as an Inventor and an Advocate of the American Patent System."

BENJAMIN FRANKLIN.

The printers' and literary societies of New York and other places celebrated, last Saturday night, as has been the case in some instances for over 100 years, the birthday of Benjamin Franklin.

This great man was universally beloved; he was the idol of his time; he was wise beyond his fellows; he was an inventor, a philosopher, physicist, diplomat and thinker; but above and beyond all, he was an American of the truest blue type.

At a time when this country needed every encouragement from the friendly foreign powers, Benjamin Franklin was sent as United States minister to France. By his good, hard, American common sense, more than anything else, he made himself known, talked about and liked more than any other foreigner at that time in France. He was taken as a type of a race which had been hitherto considered savages; by his actions he gained the friendship of France for his country.

In the electrical field, Franklin, lightning and kite are the three words naturally occurring together at mention of his name. His famous experiment with the kite was made June 15th, 1752. The French Academy of Sciences, however, did not recognize Franklin as the inventor of this experiment, but awarded the merit to M. Romas, who is said to have done the preceding year just what Franklin did in 1752.

Franklin's fame as a philosophical genius rests especially upon his conception of his theory of electricity, which with slight changes and additions, is used to-day to express the connections, relations and multiplicity of facts and phenomena which have arisen since his time. The Franklinian theory, as is well known, is that hypothesis which supposes that all the electrical phenomena are produced by the disturbance of one highly elastic fluid which pervades the earth and all material bodies.

Besides being an earnest delver into electrical science, especial electro-magnetism, Franklin was an author of electrical books. One, notably, was his "Observations on Electricity," containing letters written in 1749–50. This work was published in London in 1869 and is full of interesting statements.

Born in Boston, January 17th, 1706, he lived a life of usefulness and honor, and died in Philadelphia, a city which he loved, April 17th, 1790.

In the matter of rapid transit New York is confronted with a condition and not a theory. Electricity will solve the problem. The subject was treated editorially by the *Evening Sun* in a recent issue. We reproduce this sensible article in another place.

Mayor Grant, after making an inspection trip to Boston, is said to be in favor of the overhead system of electric railways for the annexed district. Several daily newspapers have tried to make a political point out of the fact. It is simply the emergence of a hitherto benighted mortal into the realms of broad-mindedness and progress. The veil has been lifted, that is all.

A new ironclad for the Chilian navy, called the "Capitan Pratt," was recently launched from the La Seyne works of the Forges et Chantiers de la Mediterranee. The heaviest part of the armament consists of four Canet guns of 24 centimetres (9.45 in) calibre, mounted in separate barbette turrets, one forward, one aft, and one on each side amidships. The turrets can be worked by hand if necessary, but for all regular use hydraulic power has been replaced by electricity as a motive power for working the turrets and guns. This is undoubtedly the most interesting feature in the new vessel, and the fact that throughout the entire armament electricity has substituted hydraulic power constitutes a new departure which will be watched closely by all interested in the important question of the adoption of electricity in naval warfare. Much credit is due to the Chilian government for having taken the initiative and to M. Lagane and M. Canet for having elaborated so complete a system.

CORRESPONDENCE.

OUR WASHINGTON LETTER.

What the Daily Newspapers Call a "Riot" was started in the House of Representatives last Wednesday when the paragraph relating to underground wires, in the District Appropriation bill, was reached. The disturbing paragraph provided "that pending action by Congress upon the report of the board appointed to consider the location, arrangement and operation of electric wires in the District of Columbia, the Commissioners of said District shall not permit the construction of any conduit or subway for electrical purposes in any street or avenue of the city of Washington or Georgetown; and any and all unused permits for constructing the said conduits are hereby revoked." The object of this provision, as stated by Congressman McComas, of Maryland, who attempted to force the passage of the bill, is to insure that the streets shall be eventually used, not for the benefit of corporations, but as the property of the city, wherein electric light wires, telephone wires and sub-railways may be run in conduits, and leased at a large revenue to the city, to those who perform the functions of communication, telephonic communication or electric lighting, and that the large sums which now go to enrich private corporations may be turned into the public treasury for the benefit of the whole people. Mr. McComas believes that no city or town of 10,000 or 50,000 people has any right to barter away any right in any street, the air above, or the earth beneath, but that these privileges should be farmed out under public regulation to make a revenue for the support of the city. He expressed much anxiety—which sounded more like advice to the Electrical Commission—that it should report that it is entirely feasible for the government to build conduits and lease them, at a good profit, to private corporations. The immediate effect of the adoption of the provision quoted and of its becoming a law, would be to stop the C. & P. Telephone Company from doing a large amount of underground work for which it has made preparations, and which the District Commissioners authorized before the law providing for the Electrical Commission was passed. As the Commission is not likely to make any report for nearly a year, and as Congress may not take action on the report for another year, the injustice of the measure is too apparent to allow any hope of its passage.

Special Census Agent Foote has completed and issued his schedule for commercial telegraph companies. It embraces 48 folio pages of questions, covering almost every possible detail relating to the organization of the companies; the construction and maintenance of lines, systems and methods of transmission and tariffs of messages, classes, ages and wages of employés and hours of labor, receipts and expeditures on account of the various branches of the business, value of franchises, lines, real estate, etc. The Western Union and the Postal Telegraph Companies have agreed to answer the questions which Mr. Foote has prepared. He is the first government official who has ever been able to do any business with the Western Union without getting into a fight, and his success in securing harmonious action in a matter of so much importance is remarkable. The information to be obtained through this census investigation of telegraphs will be of immense value, and it is to be regretted that the scope of the investigation, now so well organized and established on a practical basis, cannot be continued for several years and enlarged so as to provide for securing comparative statistics of the telegraphic systems of foreign countries. One effect of the promulgation of Foote's schedule has been to spur the advocates of the postmaster-general's postal telegraph scheme to more active efforts to get the measure put through Congress during this session. If it should be postponed until after the facts which the census reports will bring to light are published, it will probably be defeated.

The Washington and Georgetown Railroad Company has purchased an entire square of ground, containing more than one acre, on the south side of Pennsylvania avenue, nearly opposite Willard's Hotel, on which a power station, 241 by 185 feet, and six stories high, will be erected immediately. From this station three lines of cars will be operated by cable power. The main line runs the whole length of Pennsylvania avenue, from the Navy Yard to Georgetown, passing around the capitol, and another line runs out Fourteenth street into the northern suburbs. Work will be commenced at once, and the cable system will be in operation in about a year.

A Number of the Officers and Directors of the Eckington Road have gone to Philadelphia to investigate the storage motor system for the purpose of determining its adaptability to the new section of road belonging to their company, extending to the treasury department, on which they are prohibited from using anything except storage batteries or horses. The line has been built and is ready for the cars. The number of passengers carried by the Eckington Road during the year 1890 was 750,883. The total receipts were $212,935.56, and the disbursements were $201,136.72.

A Small Syndicate of Small Lawyers is endeavoring to carry on a raid against the telephone company by getting its subscribers to agree to pay ten dollars apiece when the syndicate succeeds in lobbying a bill through Congress compelling the company to reduce its rates by about 50 per cent. No sensible reason is given in support of the attack, and its failure is certain.

A Few Evenings Ago the fire department was called to the White House by an alarm from the automatic apparatus in use in the building, just as a public reception was being held. Much excitement was caused, but the alarm proved to have been accidentally given. The real cause of the disturbance could not be discovered, but an investigation resulted in the usual verdict against the electric light wires, with some reservations in favor of the rats.

Supt. J. E. Powell, of the Treasury Department, has been very ill with typhoid fever for the last six weeks, but is now in a fair way to recover. G. C. M.

Washington, D. C., January 15th.

OUR BOSTON LETTER.

Mr. C. A. Coffin, vice-president and general manager of the Thomson-Houston Electric Company, has engaged a suite of handsome rooms at the Brunswick, this city, for temporary use by himself and family.

Electric Cars will soon supersede those heretofore drawn by horses at Biddeford and Saco, Me. The directors of the street railway operated in and between the towns named held a meeting on Wednesday and unanimously agreed to adopt electricity.

The New Station of the Naugatuck, Conn., Electric Light Company is nearly finished. The officers of this company report an encouraging outlook for a largely increased demand for both arc and incandescent lights.

The Narragansett Electric Light Company, Providence, R. I., has increased its capital stock from $400,000 to $600,000, and the addition will be offered to shareholders at par. The late annual statement showed 8 per cent. paid on $400,000, and a surplus of $20,000.

The Edison Electric and Illuminating Company, of this city, has reported these operations:

	1890.	1889.	1888.
Gross earnings.....	$488,595	$327,678	$226,301
Expenses and taxes.....	259,517	203,647	110,066
Net earnings.....	229,078	124,031	116,235

Mr. J. R. McKee, son-in-law of President Harrison, will be the general manager of the Thomson-Van Depoele Electric Mining Company. Mention was made regarding this enterprise in our January 17 issue.

Col. A. L. Rohrer, for several years an official at the Lynn, Mass., factory of the Thomson-Houston Electric Company, has been elected president of the Lynn Board of Trade.

Messrs. J. F. Perry and E. J. Richards have formed a partnership and are located in the Fuller Block, Lynn, Mass. They are contractors for isolated electric lighting plants, electric railways and general electrical construction. Mr. Perry was for some time the manager of the Lynn Gas and Electric Company; and Mr. Richards was for several months the superintendent of the Beachmont, Mass., electric light station.

Mr. Edward H. Kitfield, formerly with the Thomson-Houston Electric Company, has started in business for himself as a civil engineer, and established an office in the Vulcan Building, No. 8 Oliver street, Boston. Mr. Kitfield is competently qualified to prepare complete plans for electric lighting and power stations, or make surveys and drawings of any kind.

The Holyoke Electric Light Station, at Holyoke, Mass., is nearly finished; yet it may be the last week in April before the machines are started. The horse-power capacity of the station will be about 1,800; of this 1,000 horse-power will be furnished by water, and the remainder by steam.

The Jewell Belting Company, Hartford, Conn., has finished the new brick building adjoining its factory, 96x60 feet, five stories high above the basement. An extension 32x18 feet has also been built by the company, which has been finished in hard woods, and will be arranged for the private use of the executive officers.

New Electrical Patents.—A patent has been granted C. J. Van Depoele for an electro-dynamic motor for alternating or pulsating currents, comprising a wire-wound armature, an electro-magnetic system surrounding the armature for producing magnetic currents therein by induction, thereby establishing poles in said armature, and a field magnet arranged to react upon the armature poles produced by the induction system. Another motor patent, issued by Mr. Van Depoele, comprised a closed circuited armature having a coil in inductive relation thereto, a field magnet and a single external source of current therefor, and coils in secondary relation to the coils of the field magnet and connected to the induction coil of the armature.

Boston Electric Club Dinner.—The inaugural dinner was held at Young's Hotel, Friday evening January 16, and was attended by a distinguished gathering, Vice-President C. J. H. Woodbury presided, in the absence of President Griffin, who was prevented from attending the dinner on account of sickness in his family. Among the guests were ex-President H. B. Cram, Col. C. M. Ransom, William N. Colan, of London, Eng.; Thomas F. Goodrich, vice-president Niagara Institute, New York; William D. Warner, chairman house and entertainment committee; B. S. Flanders, municipal supervisor of electric wires; R. F. Ross, Dr. George L. Austin, George W. Mansfield, Frank Ridlon, W. J. Denver, S. E. Barton, Henry R. Turner, C. F. Pollard, H. H. Eustis, R. T. Robinson, W. E. Holmes, W. C. French, J. R. Magee, L. S. Dumoulin, A. L. Rohrer, C. A. Baldwin, F. M. Gilley, A. P. Brickett, C. A. Hawkins, A. G. Howes, F. J. Boynton, W. C. Fish, W. J. Clark, F. M. Ferrin, J. L. Kimball, T. Stebbins, George R. Lean, F. E. Pettingill, George W. Adams, Alexander Hill, G. M. Goddard, J. C. Wilson, W. I. Barker, W. J. Keep. The principal guest of the evening was Mr. William N. Colan, of London, England, president of the Society of Engineers, and member of the Institute of Civil Engineers of Great Britain. The meeting, while in the order of the monthly gathering, was also complimentary to the new board of officers and to those who had been succeeded. Mr. Woodbury made an excellent presiding officer and toast-master combined. After the various courses had been served, and cigars lighted, the president *pro tem.* called the meeting to order, and after a few interesting remarks regarding the standing and progress of the club, he called upon ex-President Cram, who said he was now out of the official harness—in fact, he felt that he was a back number. He thanked the members for the expression of good will that had always been shown him, and earnestly hoped the organization would continue to flourish in the future as it had in the past. The club should not be confined to feasting and sociability, but be of practical benefit to all its members, no matter in what direction their interests may tend. Colonel C. M. Ransom followed with a brief yet entertaining account of the club from its organization to the present time, and closed with the prediction that the club would continue to increase its influence and enlarge its membership. Mr. W. N. Colan, the visitor from abroad, was then introduced, and he delivered a very entertaining address on the progress of electrical invention in his own country. He felt proud of the honor to be called upon to speak before a congregation of American gentlemen, and prouder still to be called upon in behalf of his native country. Other speakers were Captain Flanders, George W. Mansfield, R. F. Ross, Dr. G. L. Austin and Frank Ridlon. At a late hour the happy event was brought to a close, and each guest departed for his respective domicile, delighted with the enjoyable time he had experienced.

Boston, January 17th, 1891. W. I. B.

OUR CHICAGO LETTER.

G. A. E. Kohler reports the sale of 22 horse-power in Eddy motors during the past 20 days. Mr. K. has removed his office to 331 Rookery.

The Electric Construction and Repair Company, 205 and 207 Canal street, are sending a very neat and attractive catalogue to the trade. It embraces a number of little notes relative to the work done by the company.

George Cutter has received, recently, the agency of a number of specialties, prominent among which are the Morris pole top for street railway work and the Schaefer Incandescent lamp.

The Standard Oil Filter Company which was recently organized, has opened an office at 195 Canal street. The company report a large amount of orders and a growing demand for their imported filter.

The Bain Electric Manufacturing Company, which recently succeeded Foree Bain, will remove during the month of February to 47 and 49 So. Jefferson street. The change in the company is only in the name, Mr. Bain still remaining president and general manager. D. B. D.

Chicago, January 17th.

OUR ALBANY LETTER.

The Legislature of New York met at Albany on Tuesday. A short session was held and Speaker Sheehan of the Assembly announced the standing committees, among which was that on "Gas and Electricity," as follows: Dempsey of Oneida, Lane of Otsego, Kelly of Kings, Mullany of New York, Gorman of Albany, Webster of New York, Osborn of Dutchess, Stranahan of Oswego, Johnson of Wyoming, Gallagher of Erie, Jones of Monroe.

Mr. Demarest introduced a bill to prevent the use of currents for electric light or power of greater strength than 600 volts by any corporation or company. Adjourned until Monday. L. M. W.

Albany, N. Y., January 17th.

OUR ST. LOUIS LETTER.

Since the First of the Year two more electric street railway lines have started up. The Market street division of the Missouri Railway Company began to operate its line by electricity on Monday, January 12th. It has adopted the Thomson Houston system. The other line to start up is the Southern Railway. It also uses the Thomson-Houston system. It is now running the whole line by electricity.

A Meeting of the stockholders of the Benton-Bellefontaine Railway Company has been called to consider the advisability of issuing $500,000 in bonds to be used in converting the road to an electric one and in extending the line two miles.

Since the Lindell Railway has been running by electricity its travel has been more than doubled, and the company has found it necessary to order additional cars.

St. Louis now has ten electric street railways in actual operation, viz, Seventh street branch of the St. Louis Railway, St. Louis and East St. Louis Electric Railway, Southern Railway, Missouri Railway, Mound City Railway, Chouteau avenue division of the Lindell Railway, Lindell Railway proper, Vandewater avenue line, and the Union Depot line and branch. Of the total number, one is of the Short system, six are Thomson-Houston, and three Sprague.

Speaking of Electric Railways reminds me that a new and most successful novelty in that line is the Bagnall crossing. It has been universally adopted in St. Louis and is working splendidly where all others failed. It is being put on the market by the Emerson Electric Company. This firm is also getting out some new designs in arc hooks, cut-outs, etc., which are meeting with a good demand.

Another Company which does not allow the grass to grow under its feet is the Western Electrical Supply Company. Its new plant in Centralia, Ill., was started up New Year's eve and proved a great success. The plant is of the National system, has a capacity of 650 lights, and employs the Russell engine. It is intended to light the town.

Another Plant with the National system is one at De Soto, Mo. It has a capacity of 1,000 lights. It is also for city lighting. Cape Gerardeau has also adopted the National system for its city lighting and has established a 300 light capacity plant. Mr. Irvine, the agent in St. Louis for the National people, reports a very good business for this section.

The Pond Engineering Company have just finished a steam plant for the Consumers' Electric Light and Power Company, at De Soto, Mo., consisting of two 100 horse-power boilers, one 100 and one 75 horse-power Armington & Sims engines, both of which were started up in the latter part of December. The same company is putting in a large plant of 500 horse-power at New Albany, Ind., using two 250 horse-power Armington & Sims engines, connected with countershafting and clutch pulleys. The New Dallas, Tex., office of the Pond Company has sent in a large order from Corpus Christi, Tex., and their San Francisco representative has sold two Armington & Sims engines, of 150 and 115 horse-power to the United States Navy, for use at the Mare Island Navy Yard.

The Union Electrical Construction Company has failed under an attachment taken out by the Southern Electrical Construction Company.

Suburban.—Belleville, Ills.: The Belleville and East St. Louis Electric Railway Company has filed its acceptance of the franchise granted by the Belleville Council. According to the agreement, the work of construction must be begun inside of three months and must be completed inside of six. The company expects to extend the line as far as East St. Louis, and thus have direct street car connection with St. Louis. —Centralia, Ill.: On the 2d of January the Electric Light and Power Company, of Centralia, held their annual meeting for the election of officers. Mr. J. T. Wilson, the energetic manager of the Western Electrical Supply Company, of St. Louis, was chosen president of the concern. The other officers are J. J. Wetmore, vice-president; S. L. Dwight, secretary and treasurer; James Benson, superintendent. W. H. B.

St. Louis, January 14th, 1891.

After several years of agitation for an electric street railway system in Bridgeton, Pa., a number of local capitalists have formed a company and made application to the city council for permission to lay tracks on the streets. The officers of the company are: President, Judge James R. Hoagland; secretary, Francis R. Fithian; treasurer, William O. Garrison; directors, James R. Hoagland, Charles S. Fithian, Frank M. Riley, Clement W. Shoemaker, Benjamin Hancock, William O. Garrison and Francis R. Fithian. A route covering all parts of the city has been mapped out, and the projectors hope to have the road in working order in a few months.

Telephonic News

⁂ The American Bell Telephone directors authorize the issue of $2,500,000 new stock April 1.

⁂ It is reported that the New England Telephone and Telegraph Company put over $200,000 into metallic circuit extensions last year.

⁂ A force of telephone linemen have been making the periodical repairs to the telephone line across the river at Elizabeth, Pa., rendered necessary as a result of boats' chimneys coming in contact with the wires during high water.

⁂ A Willows, Cal., paper says that Jeff Garnett has utilized three miles of barbed wire fence for a telephone. It runs from his old home to his new residence. A small wire is attached to a telephone in each house, and thence to the wire fence. Good boy, Jeff!

⁂ The American Bell Telephone directors have voted to recommend to the stockholders of the company the issue, April 1, of $2,500,000 new stock, making the total capital stock $15,000,000. A special meeting of the stockholders will be held in Boston January 27, and the new stock will be issued to stockholders of that record.

⁂ The cable forming the submarine connection between the London and Paris ends of the telephone line connecting those cities has been completed, and the land work being already well advanced, it is possible that the telephone line may be opened early in the New Year. There are two lines, with going and return wires, so that two persons will be able to use the telephone between the respective Exchanges (the Royal Exchange and the Paris Bourse) at the same time.

The City that has the Columbus Fair.

[*From the Jewelers' Circular.*]

Chicago always on top.—New Yorker: "The value of the diamonds stolen in New York during 1890 was more that $50,000." Chicagoan: "It was more than $75,000 in Chicago. Why, almost every one was arrested for stealing more or less."

The Bell Patent.

According to the annual report of Attorney-General Miller, recently submitted, it is not probable that any decree will be reached in the suit of the government against the Bell Telephone Company before the time of the expiration of the Bell patent, which this suit was brought to overthrow. The cross-examination of a single government witness has occupied no less than 70 days, and this interesting witness was still on the stand when Attorney-General Miller's report was finished. Since then the government has asked for further time in which to take testimony, indicating that the prosecution is not unwilling to prolong the case. This looks very much as if the government had not much faith in its own cause.—*Boston Herald.*

Glass Insulators.

A significant fact in illustration of the way work goes abroad may be mentioned in connection with the special glass insulators used in Crompton's system of underground mains, says the London *Electrical Engineer*. When the system was first drawn out on paper, and the design of insulator decided upon, quotation was asked for from several English firms with a request for specimens to be submitted. Without exception, those asked refused to do this unless a definite order for so many thousands was given. At this juncture, a German representative called, saw the design, at once offered to submit samples, quickly did so, with the result that orders for tens of thousands of these glass insulators have gone to Germany. Thus, does want of enterprise on the part of English manufacturers bring about its own punishment.

An Old Telephone Switchboard.

BY MORRIS F. TYLER.

The accompanying illustration represents what is probably the oldest telephone switchboard in existence. It is the switchboard set up in Meriden, Conn., very soon after the opening of the exchange in New Haven, and was in operation as early as the first week in February, 1878. It was modeled on the original New Haven switch, which, unfortunately, is now destroyed.

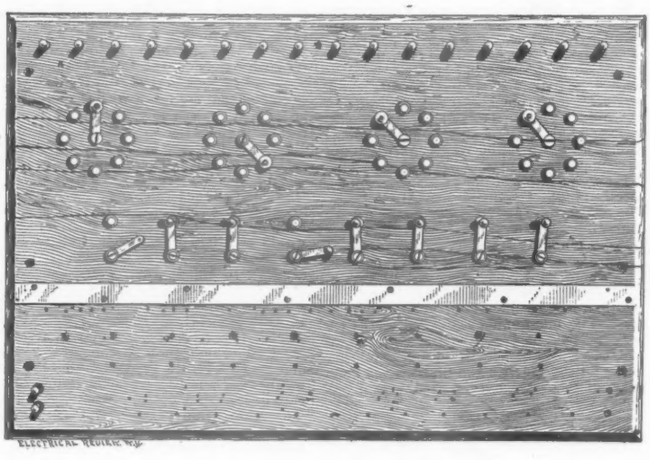
Across the top is a row of 16 binding posts; below appear four circles of metal buttons; in the center of each circle is pivoted an arm which can be brought into contact with any one of the buttons. There are eight buttons in each circle. Next below these is a row of two-point switches playing between a button similar to that in the circles and a continuous strip of metal which is seen across the board below.

In the lower left hand corner are two binding posts, and when the board was in use there was a similar pair in the lower right hand corner. To these two lower pairs of binding posts telephones were attached, the telephone wire running from the upper part of the pair on each side to the end posts on each side of the upper row and thence to ground, and from the lower post to the ground strip. The 14 posts across the top between the two terminal posts are alternately line and annunciator posts. Subscriber's line No. 1 came in, for instance, in the second post of this upper row, then it passed to the top button of the circle immediately under it, and from there was legged across to the top button of each of the circles. From this button in the first circle it passed to the switch below the circle. The button above this switch is connected with the annunciator and battery through the third post in the row. The other point of this switch, or the bar, goes to the telephone and ground in that direction. The next pair of wires was appropriated to button No. 2, or the next right hand button of each circle and went through a similar course of wiring. The button No. 8, or the one to the left of the top button of each circle, is zero point.

When no wire was in use each of these switches rested upon that button, as is shown in the third or fourth circles of the illustration. That left the subscriber's wire connected with the annunciator by means of the lower switch. When the call was made, the lower switch was brought off the annunciator point by turning to the right, and the subscriber's line carried to the office telephone and ground by coming into contact with the bar. After it was learned whom the subscriber wanted, this connection was thrown off and the switch corresponding to the line of the party wanted was turned down to the bar and call was made. After that subscriber was raised, the switch in circle No. 1 was put on No. 1 pin and the switch in circle No. 2, if it was subscriber on wire 4 that called, was put on the fourth pin, and the ground switch in both instances turned open. The switches of these circles were connected in pairs; that is, the first and second and the third and fourth circles were connected together. This left the two subscribers' lines connected with one another, but cut out of office telephone, of ground, battery and annunciator, so that the subscriber could not call the central again until the operator, by turning one of the lower switches, threw him onto the office telephone. The switch as it stands in the illustration is set for conversation between parties on lines 1 and 4, with the other lines in calling condition.

This switch accommodated seven wires, on which were 50 subscribers, but only two conversations could be carried on at the same time. The call was what was known as the old buzz box. The annunciator, which is not shown here, was a Watts & Company annunciator, working through relays. The whole system was operated on closed circuit.

The primitive character of construction will be recognized from the fact that the buttons in the circles are the heads of carriage bolts, which have been slightly turned down, and were once nickel-plated, and the knobs upon the switches in the circles are knobs used upon tin teapots. The wiring on the back of the switch was of ordinary office or paraffined cotton wire.



THE OLDEST TELEPHONE SWITCHBOARD.—(SEE MR. TYLER'S INTERESTING DESCRIPTION.)

Wooed by Wire.

A romantic wedding took place last week at Uvalde, Texas. H. H. Hoover, day operator in the dispatcher's office at the Southern Pacific depot at San Antonio, was married to Miss Nellie Tamsett, operator and station agent at Uvalde.

They became acquainted with each other some time ago over the wires and whiled away their leisure time ticking soft messages. Not long ago Miss Tamsett became sick with typhoid fever and was brought to the Santa Rosa Hospital, in Uvalde. Hoover met her then for the first time, and during her long illness visited the hospital daily. They fell in love and an early wedding followed her recovery.

Electric Railway Fight in Philadelphia.

Bills in equity have been filed in the United States Circuit Court at Philadelphia, by the Electric Car Company of America and the Thomson-Houston Electric Company against the Neversink Mountain Railroad Company and George F. Baer, D. N. Stehman and Paul Milholland, of Reading, president, treasurer and superintendent of the defendant company. The complainants allege that the defendants are infringing upon patents for the manufacture of electrically propelled vehicles, and complainants ask for an injunction and an accounting for the profits derived from such infringements.

Management of Electric Light Plants on War Vessels.

The following instructions regarding electric plants on United States war vessels have just been issued by the Electric Bureau of the Navy Department:

At the time the ship goes into commission the entire plant is supposed to have been previously tested with everything in place on board and accepted. Previous to the test for acceptance, the dynamo and engine are supposed to have been inspected at the factories, and the wiring inspected as the work of installation progressed. A general graphic description of the plant will be found in the "Record of Electrical Appliances" which is supplied to the vessel. Nothing remains then but to keep the plant in a thoroughly good and efficient condition during the cruise. To this end the following rules and suggestions for the care and management of the plant will be carried out.

DAILY TEST.

The ground detector will be kept in use at all times whenever the plant is in operation. This will at once indicate the presence of a leak to earth of any importance. The branch circuit in which the fault occurs must at once be located and the use of that circuit discontinued until it is again in order. It must be strictly borne in mind that to make this detector of any use, the faults must be removed as soon as they appear, or the circuit in which it occurs cut out, for it will not indicate a second fault until the plant is cleared of the first. On the other hand, with proper care, the ground detector is invaluable. In addition to the above, whenever any of the machines are shut down, advantage must be taken of this opportunity to test them for leaks between the coils and dynamo frames. If the fault that occurs is of slight importance, it may at times be advisable, after locating it, to allow it to remain until it becomes worse, measuring its resistance, however, and noting its progress.

WEEKLY TEST OF SEARCH-LIGHTS.

These will be operated at least once a week at night to see that everything about them is in good working order and the fact recorded in the journal. At such times care will be taken to have the ground detector connected.

QUARTERLY TEST OF PLANT.

Once a quarter measurements must be made of the insulation resistance of the entire plant connected up together, also that of each dynamo and of each of the section circuits leading from the switchboard. At such times advantage should be taken of wet weather if possible. At least once a quarter the entire plant must be operated for a long enough time to see that everything is in working order. At this time everything must be connected up; that is, all lamps, search-lights, motors, etc., within the safe limit of out-put of the machines.

QUARTERLY REPORTS.

These shall contain the results of the quarterly and any special tests that may have been made, as well as the expenditure of all articles used in operating the plant, and its condition. The record should be kept in such a state that the cost of operating the plant can at any time be figured. The behavior and condition of engines, dynamos, lamps, and in fact the entire plant, must be noted, as well as the cause of every fault that occurs. In addition to the above, special reports must be made when necessary for the efficient condition of the plant. The blanks for lamp reports must contain such complete information as the headings call for. Copies of all reports made by the officer in charge must be made and retained on board.

CARE AND MANAGEMENT OF PLANT.

Too much care cannot be exercised to see that the entire plant is kept in order. Constant watchfulness on the part of the attendant and observation on the part of the officer in charge, to see that the attendants are kept up to their work, is absolutely necessary. One fault of itself is frequently of small importance, but when another is allowed to appear in addition, then serious trouble is liable to occur. Too much care cannot be given to the engine. Keep all working parts clean and lubricated. Inspect frequently for any undue wear or lost motion, and keep the drains and other appendages in order. Be economical in the use of oil and other stores. Notice the cause of any unusual noise about the engines. In long leads of pipes, with many bends and branches usually found on shipboard, more or less condensation takes place; this, together with the fact that steam aboard ship is more or less wet, requires that every precaution should be taken to prevent water getting into the cylinders, which in high speed engines will do much damage in a very short time. The tachometer will not ordinarily be used even if supplied; the shaft portable speed indicator will ordinarily answer every purpose. *Be particularly careful on starting to run slow until warmed up and water out of cylinders.*

Every engine belonging to the electric plant, boat outfit, etc., should be turned over

by hand every day when not in use, and the fact noted in dynamo journal.

In starting engine the dynamo brushes should be raised. After engine is running smoothly see that brush-holders have not been shifted from marked positions, and see that main switch is open. Lower brushes, and if dynamo has switch in shunt field, close it. Adjust brushes until there is no sparking, noting voltage at same time; then close main switch, noting that all section switches are open. Throw on load gradually, attend brushes at each change of load and shift if necessary.

In shutting down dynamo, follow the reverse of the above. In cases when it is known that certain lights will be wanted immediately after starting up, a reasonable load will be put on as soon as the engine is running smoothly and before commencing to speed up, in order that the lamps may attain their candle power gradually and their life thereby increased materially.

As regards the dynamo, the commutator and brushes are what require the most attention; that is, the brushes to be kept trimmed at the neutral points, and the commutator kept smooth and free from uneven wear. All connections kept tight and clean; copper dust, oil, and moisture kept off the machine and the machine properly lubricated. The pilot lamp must always be kept in circuit in case the main safety fuses go. Be on the watch for any unusual heating of the field-magnets or any softening of the insulation. In throwing dynamos in parallel care will be taken to see that each machine is poled right and kept on open circuit until the normal potential is reached, before being thrown into circuit. All important instruments must be standardized at least once a quarter, if practicable, and the fact noted in the quarterly report.

When not in use the engines and dynamos must be covered.

The record book supplied the ship with outfit contains a general graphic description of the plant. The changes will be noted in this book from time to time so that the thread can be easily picked up. No change will ever be made in the original plan of wiring or extra outlets run without at once notifying the Bureau.

In the dynamo journal the remarks are to be made as complete as possible. The columns of the journal are to be kept as at present, except that the revolutions will not be recorded as long as the plant is in good working condition. The load for each dynamo will be recorded in its proper column at the end of each hour, unless there is an unusual load on at the time, when the average for the hour will be recorded.

All faults or bad working of the plant in any respect must be noted in the journal.

As regards the circuits, careful daily inspection of connections is necessary to keep them clean and tight, also look for deterioration of the insulation of the wires. The lamps farthest from the dynamo must, after a time, be shifted near the dynamo in order that they may continue to give their normal candle-power.

All lights and fixtures in general use should be inspected and cleaned every day. In cleaning fixtures, especially plated ones, scouring or hard rubbing will not be permitted. They should be wiped off with a cloth or chamois skin.

As previously mentioned, the commutator must be kept free from uneven wear. The necessary evil of all continuous current machines is the commutator. Not only must the brushes be trimmed and placed so as to prevent sparking, but they must also have their position changed from time to time in the direction of the length of the armature, so that the entire surface of the commutator will have the same amount of wear.

During target practice the search-light projectors should be trained and clamped so that they will be parallel to the line of fire, and, if practicable, the door opened slightly in order to save the lenses from the destructive effects of concussion.

The use of files, sand, emery paper, etc., on commutators is prohibited, except in extreme cases, when it will be fully noted in the journal, and then only by the direction and under the personal observation of the officer in charge of the plant. Under no circumstances whatever will these be used unless the brushes are lifted from the commutator.

When a record is being kept of the life of a number of lamps, the fact must be noted in the dynamo journal in such a manner that it will be brought to the notice of a new officer taking charge of the plant.

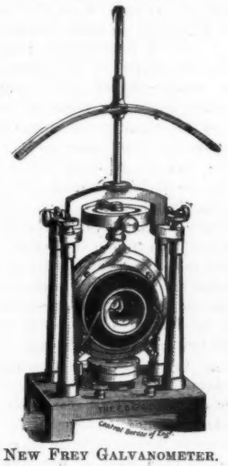
The safety fuses will not be replaced with the current on, unless it is absolutely necessary. Even then it must be done by skilled hands and with extreme caution, as the slipping of a screw-driver is liable, in such cases, to put the entire part of the ship supplied by that section in darkness.

The dynamo journal will be submitted upon the last day of every month for the approval of the commanding officer, and when filled, forwarded by the first favorable opportunity to the Bureau. Unbound journal sheets are furnished for use in dynamo room. Each sheet is intended to last two days.

The original invoice, when a vessel is commissioned, will show the electric plant as installed ready for operation, the different articles being enumerated. Spare articles and stores should be separated from the installation. Care must be exercised in making quarterly returns that all articles on board connected with the plant are enumerated whether found in the installation, among the spare articles or in the stores.

Frey Portable Reflecting Galvanometer.

This instrument, the invention of Mr. Charles P. Frey, chief electrician of The E. S. Greeley & Company electric laboratory, embodies the essential features of Thomson's reflecting galvanometer, and is extremely sensitive. Its principal feature is that it can be instantly prepared for use by releasing the coils, which are suspended by means of a universal joint, and thus require no leveling. When not in use, the fibre suspended magnet and mirror, as well as the pendant coils, are securely locked by means of a compound bolt operated by one turn of an independent key, doing away with the danger of breaking the fibre, a danger to which the ordinary type of fibre suspension is extremely liable when at all roughly handled, and one which may be a serious annoyance.



NEW FREY GALVANOMETER.

This galvanometer is especially adapted for rapid subway testing, since it may be rendered direct reading by attaching a pointer. For more delicate tests, by using a lamp, stand and scale, a high figure of merit may be obtained.

This galvanometer, protected by letters patent, is being placed on the market by The E. S. Greeley & Company, of New York.

The Electric Car Cure.

[From the *Evening Sun*.]

The time is coming, undoubtedly, when every surface and elevated car running in this town will be propelled by electricity. Neither horse nor steam can hope to keep its present place in what is termed "the triumphal march of progress."

In view of this certain promise of electric cars, it is an instructive meditation to trace the change in popular belief regarding electric cars, as their number increases gradually. A few years ago, when it was proposed to begin running a few such cars on the Fourth avenue street railway, the gravest fears were entertained that they were unsafe things to ride in. When the street railway company applied to the Honorable the Board of Aldermen for permission to substitute an electric propulsion for traction by horses in some of their cars, Alderman Dowling expressed the greatest concern for the public safety, which he thought would be imperilled by such risky devices. Said he, as nearly as his words can be recalled: "Gentlemen, do you know what it is proposed to do? They want to store the electricity in jars under the seats of the cars. You know what deadly stuff this electricity is. In case of collision, or other street accident, what, I ask you, would be the result? Why, these jars would be broken, of course, and the electricity would burn the heads and limbs o' the helpless women and children in the car, not to speak of the men."

In spite of this really impassioned appeal, however, permission was given to the railroad company to run a few electric cars, and they have been running a few ever since. But in less conservative communities than New York, where precedent and settled habit count for less, such as St. Louis, Chicago and Boston, electric cars have come into great vogue, and a Boston poet named Holmes has even written and printed a poem about them. No St. Louis poet has been heard from as yet, but on the other hand, in that city the electric cars have found favor with the people as so many rolling sanitariums in which rheumatic persons can receive benefit, and they find that the faster the cars go the less they (the rheumatic persons) ache. The conductors on the electric cars have grown to assume quite a professional manner, and each has his particular patients, who wait for his car and detail their cases to him while he rings up their fares.

It is very gratifying to see that subtle essence whose ravages were so feared by Alderman Dowling now tamed and humanized, and doing so gentle an office, cognate, indeed, to that of a *masseur*, or an attendant in a Turkish bath. This beneficent work of electricity will grow and broaden in the natural course of things, after the adoption of that motive power on all the elevated and surface roads in this town. If we may suppose a train on the Third avenue elevated railroad, for instance, well packed on a rainy day with assorted persons in a damp condition, it will be seen at once that the whole atmosphere of the car, or perhaps of the whole train, would be one great thrill, in which rich and poor would be invigorated alike.

It would inevitably come about that rheumatism would become a lost art in New York, and the electric treatment on the railways would go far towards supplying free medical attendance for everybody. A bad circulation is at the bottom of many disorders of the flesh, and if by the simple process of jumping upon a street car you could receive competent electrical excitement of the tissues, and disperse all accumulation of lactic acid, you would save many doctors' bills. Of course, the greatest sufferers from rheumatic affections would take the express trains on the elevated roads for treatment, while those who only desired a gentle stimulation would try a cross-town car, on almost any of the lines.

The work of electricity as a benefactor of the race has hardly begun. The beams of the little candle lighted by the ingenious rheumatic persons in St. Louis are bound to shine round the world.

PERSONAL.

Mr. W. J. Denver, ex-president of the Boston Electric Club, was a visitor in New York last week and made a welcome call on the REVIEW.

Mr. Theodore Moss, secretary of the New York Board of Electrical Control, has been confined to his house during the past week by a severe cold.

Mr. J. B. Sargent, New Haven's new mayor, in his inaugural address, advocated municipal ownership of street railways, gas and electric plants.

General Superintendent T. A. Sheffler, of the Westinghouse Electric and Manufacturing Company, on Saturday resigned. He will go with C. S. Pease to the Brush Electric Company.—*Pittsburgh Times.*

Mr. G. H. Fisher, formerly the secretary of the American Leather Link Belt Company, has become manager for Charles A. Schieren & Company, manufacturers of the celebrated patent perforated electric belting, 226 North Third street, Philadelphia, Pa.

Mr. William M. Roberts of Duluth, Minn., vice-president of the Hartman Electric Company of that city, was a New York visitor last week, and made the ELECTRICAL REVIEW office a pleasant visit. Mr. Roberts is looking into the electrical business of the East, and renewing acquaintances with a number of old friends.

TELEGRAPHIC

.... The Western Union has reduced rates between Topeka and other Kansas points.

.... Secretary Dam, of the Oakland, Cal., Board of Public Works, has advertised for 160 telegraph poles.

.... At the annual meeting of the Chester and Derry Telegraph Company, held in Boston, last week, John W. Noyes was chosen president, Arthur H. Wilcomb clerk and superintendent, and C. S. Wilcomb treasurer.

.... Notwithstanding the interruptions to the telegraph service by the weather of the last 10 days, the Western Union test office receipts during the past week show an increase of $14,000 compared with the corresponding week of last year.

.... The telegraph wires between the Union Depot and the Bethlehem, Pa., Iron Works, 18 in number, have been taken down and new heavy copper wires stretched in their place. It is said that the gases from the zinc and iron works in the immediate vicinity assist very materially in rusting and eating up the wires.

.... The postal telegraph bill was called up for consideration in the House committee on post offices and post roads shortly before 12 o'clock, Jan. 9. Some parliamentary discussion arose, however, as to whether the bill had been reported by the sub-committee and was properly before the full committee. The hour of 12 o'clock arriving, the further discussion went over till the next meeting.

.... Communication with Chili by cable, *via* Galveston, was interrupted for a few days last week for all points in Chili south of La Serena. Official dispatches regarding the revolutionary disturbances in Chili were sent to Washington by way of the Argentine Republic. Business over the wires of the Central and South American Telegraph Company was much obstructed for a time.

.... At the annual meeting of the Montreal Telegraph Company, last week, Mr. Wm. Wainwright, in the absence of Mr. Andrew Allan, the president, who is suffering from a cold, presided. The annual report was read and adopted, and the old board of directors re-elected, as follows: Messrs. Andrew Allan, Hector Mackenzie, Jesse Joseph, William Wainwright, John Duncan, Henry Archibald and William Rae. At a subsequent meeting of the new board, Mr. Andrew Allan was re-elected president.

The Postal Telegraph Bill Pleases Wanamaker.

Postmaster-General Wanamaker has written a letter to Representative Evans, of Tennessee, chairman of the sub-committee of the post office and post roads committee, in charge of the postal telegraph bill, in reference to the action of the committee on the measure.

"I learn with great pleasure," he says, "that you intend as chairman of the sub-committee on postal telegraphy, to ask the general committee to vote upon the question of reporting the bill to the House. The long time that has elapsed since the bearing before the committee began, and the widespread public interest in the question, as evidenced by communications to the department, seem to warrant the expectation that early action will be taken.

"Any decision of your committees," he says, "will at least let the people know how postal telegraphy stands."

Mr. Wanamaker appends to his letter a report made by Mr. Bingham, the present chairman of the committee, in the Forty-seventh Congress, recommending the passage of a postal telegraph bill.

* * Electric cars are now running regularly between Ann Arbor and Ypsilanti, Mich.

* * The East Reading, Pa., electric railroad directors have declared a semi annual dividend of three per cent.

* * A petition for a charter for an electric street railway for Winsted, Conn., will be presented to the legislature of that State during the present session.

* * The work of removing the center poles and substituting side poles has been completed on the electric railway near Santa Clara, Cal.

* * The Hudson, Ill., electric railway carried 101,467 people during the three months ending December 31st, the first quarter of its operation, and its earnings exceeded the most sanguine expectations.

* * Since the Central Electric Company, of Chicago, divided up their offices and appointed heads to the different departments of the business, they find that they can profitably assign one man to railroad supplies, and propose to vigorously push that department of the business in future. They already control some very valuable electric railroad specialties, which will be placed upon the market with the accustomed vigor of this company.

Electrical News from Kansas City.

Electrical Business in Kansas City, Mo., until recently has been on the increase; but at this writing is somewhat quiet, yet the prospects are very flattering.

Two Large Isolated Plants are among the recent installations. These are Bullene, Moore & Emery's new dry goods house and the new Coates House. The former has the Westinghouse system (U. S.), 1,400 lights being used throughout the large building. The latter plant is the Edison system which was installed by the local Edison Company. It has a capacity of 2,100 lights.

The Edison Electric Light and Power Company are constantly adding more consumers to their already large list. Four machines have been set up lately which gives the company an aggregate dynamo capacity of 7,000 lights. The meter department of this plant is one of its most important features, over 500 now being in use, ranging from 10 lights to 200 rated capacity each.

The "Hart" Switch is meeting with much success, and the Hart & Hegerman Company who are putting these in the market cannot begin to supply the demand, being three months behind on orders. The writer saw one of the 10 ampere switches of this make tried on a 500 volt current with 10 amperes. It worked very successfully.

The Gate City Electric Company report business good. They are carrying a large stock of construction material and wire and look for a large business in this line as soon as the weather will permit construction work.

Work on the New Plant of the American Electric Light Company is progressing rapidly, and will probably be finished early in the Spring.

English, Morse & Company are making some important engine installations throughout Kansas and Missouri. A 60 horse-power Ide engine was shipped by this company on Saturday last to the Garnet Electric Light Company, Garnet, Kansas.

The Electric Street Railways are all working smoothly and giving the best of satisfaction.

Across the River, in Kansas City, Kan., the electric light company report an increasing demand for arc and incandescent lights, especially the latter, as there have been a number of large office buildings erected during the past year.

A Chance for Electricity.—The writer was told by a number of people in this metropolis of Kansas, that the elevated road there, running from the Union Depot in Kansas City, Mo., did not and never has paid, operated as it is by steam. Here is a good chance for some enterprising electric railway agent to talk the stockholders of this road into changing the power from steam to electric.

Kansas City, Jan. 12th. D. B. D.

Types of Electro-Magnets.

AN ABSTRACT OF A CANTOR LECTURE BY PROF. SYLVANUS P. THOMPSON.

If, instead of employing a cylindrical core in a coil and plunger, you employ one that is pointed, you find this completely alters the position of the maximum pull, for now the point is insufficient to carry the whole of the magnetic lines which are formed in the iron rod. They do not come out at the point, but filter through, so to speak, along the sides of the core. The region where the magnetic lines come up through the iron into the air is no longer a definite "pole" at or near the end of the rod, but is distributed over a considerable surface; consequently when the point begins to poke its nose out, you still have a larger portion of iron up the tube, and the pull, instead of coming to a maximum at that position, is distributed over a wider range.

Another way of altering the distribution of the pull is to alter the distribution of the wire on the coil. Instead of having a coned core use a coned coil, the winding being heaped up thicker at one end than at the other. Such a coil, wound in steps of increasing thickness, has been used for some years by Gaiffe, in his arc lamp; it has also been patented in Germany by Leupold. M. Trève has made the suggestion to employ an iron wire coil, so to utilize the magnetism of the iron that is carrying the current. Trève declares that such coils possess, for an equal current, four times the pulling power. I doubt whether that is so; but even if it were, we must remember that to drive any given current through an iron wire, instead of a copper wire of the same bulk, implies that we must force the current through six times the resistance; and, therefore, we shall have to employ six times the horse-power to drive the same current through the iron wire coil, so that there is really no gain. Again, a suggestion has been made to enclose in an iron jacket the coil employed in this way. Iron-clad solenoids have been employed from time to time. But they do not increase the range of action. What they do is to tend to prevent the falling off of the internal pull at the region within the mouth of the coil. It equalizes the internal pull at the expense of all external action. An iron-clad solenoid has practically no attraction at all on anything outside of it, not even on an iron core placed at a distance of half a diameter of the aperture; it is only when the core is inside the tube that the attraction begins; and the magnetizing power is practically uniform from end to end. Last year I wished to make use of this property for some experiments on the action of magnetism on light, and for that purpose I had built this powerful coil, which is provided with a tubular iron jacket outside, and a thick iron disk perforated by a central hole covering each end. The magnetic circuit around the exterior of the coil is practically completed with soft iron. With this coil, one may take it, there is an absolutely uniform magnetic field from one end of the tube to the other; not falling off at the ends, as it would do if the magnetic circuit had simply an air return. The whole of the ampere-turns of exciting power are employed in magnetizing the central space, in which, therefore, the actions are very powerful and uniform.

When one abandons iron altogether, and merely uses two tubular coils, one of wide diameter and another of narrower diameter, capable of entering into the former, and passes electric currents through both of them, if the currents are circulating in the same fashion through both of them, they will be drawing into one another. This arrangement has also been used in arc lamps. The parallel currents attract one another inversely, not as the square of the distance, but approximately as the distance. This is one of those little details about which it is as well to be clear. About once a year some kind friend from a distance writes to me pointing out a little slip that he says occurs in my book on electricity, in the passage where I am speaking about the attraction of parallel wires. I have made the terrible blunder of leaving out the word square; for I say the attraction varies inversely as the distance, and my readers are kind enough to correct me. Now when I wrote that passage I considered carefully what I had to write, and the attraction does not vary inversely as the square of the distance, because two parallel wires do not act on one another as two points. They act as two straight lines or two parallel lines, and the attraction between two parallel lines of current, or two parallel lines of magnetism, or two parallel lines of anything else that can attract, will not act inversely as the square, but simply inversely as the distance between them. The property of a coil and plunger of extending the range of action has been adopted in various ways by inventors whose object was to make electro-magnets with a sort of intermediate range, having the advantages of the powerful pull of an electro-magnet and more equability throughout the range of pull. A device of this character was invented in 1870, by Stevens and Hardy, for use in a sewing machine motor. It comprises a tubular shell of iron having a central core only partially the length of the shell. This shell co-operated with a coil, in one end of which was a short iron core to co-operate with that attached to the shell and a flange or head so that when the shell was drawn completely over the magnet a complete magnetic circuit would be formed by the shell, the flange and the two segments of the core. Another form of the plunger electro-magnet employed in the Brush arc lamps comprises a couple of tubular coils, each receiving an iron plunger connected together by a yoke, whilst above the magnetic circuit is partially completed by a sheet of iron which forms part of the enclosing box. The pull is not in any of these forms equal along the whole range of travel. It increases as the magnetic circuit becomes more complete. Another intermediate form, invented by Gaiser, employs a horse-shoe electro-magnet, the cores of which protrude a good distance beyond the coils, and the armature of which is a piece of sheet iron bent round so as to make of its ends two tubes which enclose the poles and are drawn down over them. Another design of earlier date, invented by Roloff, comprises an electro-magnet with an iron core sunk below the level of the ends of the coils and an armature furnished with little extensions that pass down into these projecting tubular ends of the coils. Some arc lamps have magnets of precisely that form with a short plunger entering a tubular coil and met half-way down by a short fixed core instead of a tube. Another form, designed by Ayrton and Perry in 1882, had an iron jacket around the coil and an iron disk at each end connected with the jacket, the disks having internal tubular projections coming comparatively close together inside the coil, thus forming a wonderfully strong uniform magnetic field between these tubular projections. The range of action can be altered by shortening or lengthening the internal tubes so as to bring them closer together or farther apart. An iron rod inserted through the tubular projections is drawn with great power and equality of pull from one end to the other of the internal tubes. In dealing with the action of tubular coils upon iron cores I showed how, when a very short core is placed in a uniform magnetic field, it is not drawn in either direction. The most extreme case is where a small sphere of soft iron is employed; such a sphere if placed in even the most powerful magnetic field, does not tend to move in any direction if the field is truly uniform. If the field is not uniform it always tends to move from a weak point to a stronger point of the field. A ball of bismuth or one of copper, on the contrary, tends to move from a strong to a weak part of the field. This is the explanation of the actions called "diamagnetic," which were at one time erroneously attributed to a supposed dia-magnetic polarity opposite in time to the ordinary magnetic polarity. A simple way of stating the facts is to say that a small sphere of iron tends to move up the *slope* of a magnetic field with a force proportional to that slope, whilst (in air) a sphere of bismuth or of copper tends, with a feeble force, to move down that slope. Any small piece of iron, a short cylinder, for example, shows the same kind of behavior as a small sphere. Ingenious devices for increasing the range of motion was employed by Page in his electric motor in 1850. It consisted of a series of coils arranged to be cut into circuits successively as a plunger was attracted through the coils. As a plunger was just entering any section the current was turned on in that section automatically, and as the end of the core passed through it the current was turned on in the next section ahead. There is a mistaken notion that something is gained by making all the spirals of a coil right-handed or left-handed. There is one particular case in which there is an advantage in winding a coil in sections, that is to say, placing partitions or *cloisons* at intervals along the bobbin and winding each of the successive spaces between the partitions full before passing from one space to the next, and that is when the coils are to be used with currents of very high potential. The tendency to pierce the insulating material by a spark is less because there is never so great a difference of potential between the windings of any two adjacent layers as there would be if the layers were wound from end to end of the whole length of the coil. Another variety of winding has been suggested, in which the coils are of wire of graduated thickness. Sir William Thomson has shown it to be advantageous to gradually increase the thickness of the wire outwardly in galvanometer coils. In designing electro-magnets, however, it is necessary to consider means of getting rid of heat, and it is obvious that the outer layers are most favorably disposed for cooling. Experience shows that the inner layers always attain a higher temperature than those at the surface. For electro-magnets, therefore, it would seem better to reverse the galvanometer plan and wind with wires that are stouter on the inner layers and finer on the outer layers. Yet another mode of winding is to employ several wires united in parallel, a separate wire being used for each layer and the terminals soldered together. Magnetically, this does not present the slightest advantage over a series of winding of equivalent section, but it has lately been discovered that the multiple wires diminishes the tendency to sparking on break of the circuit.

Researches on Secondary Batteries.

Some time ago F. Streintz, in conjunction with Aulinger, advanced the theory that in the secondary cell, the seat of the decrease of the electromotive force is to be found in the "hydrogen" plate. The theory was propounded in the *Annalen der Physik und Chemie* (*vide* series 2, vol. xxvii., p. 178).

Shortly after the announcement of this theory, F. Streintz succeeded in showing that the hydrogen plate *is* the seat of the decrease of electromotive force. This was proved by the results of some experiments on the charging and discharging of secondary cells, for during the discharge the potential of the positive plate remains practically constant, and of a value to which that of the negative plate gradually approximates.

In cells that contain only one positive plate associated with two negative plates, each of the latter may be discharged, and the potential brought to that of the positive plate, while the latter remains practically unaltered. In fact, the durability of the positive plate compared with that of the negative plate is very great.

This work was described at length in the *Annalen der Physik und Chemie*, series 2, vol. xxxviii., p. 344.

Streintz has recently been pushing his investigation further in this direction, and in conjunction with G. Neumann has succeeded in throwing more light upon the theory of the secondary cell.

As we have seen, Streintz has already demonstrated the electromotive behavior of the plates of a secondary cell on charging and discharging. The new investigation was undertaken with a view to fixing the chemical relations which take place at the same time.

For this purpose the difference of potential exhibited by various lead compounds with respect to an amalgamated plate has been investigated.

The compound to be examined was packed tightly into two strong glass cylinders, one being provided with a bright lead electrode, whilst the other was furnished with an electrode of platinum.

The zinc plate was immersed in dilute sulphuric acid, and the connection with the lead compound under examination was effected by means of a woolen thread moistened with the acid.

In order to study the variations in the potential, a sensitive quadrant electrometer was employed; the zinc plate was connected up with one pair of quadrants, and the lead or platinum electrode with the other pair.

The readings were taken till the same result was obtained with the lead electrode, as when the platinum electrode was connected with the electrometer. When this step was reached it was then concluded that the connection was metallic. When it was otherwise it was assumed to be electrolytic.

The lead compounds which were investigated in this way by Streintz and Neumann, were the following:

Lead sub-oxide or plumbous oxide..... Pb_2O
Lead protoxide or plumbic oxide..... PbO
Red lead or minimum..... Pb_3O_4
Lead peroxide or pure oxide PbO_2
Lead hydroxide (1)..... $Pb(OH)_2$ (?)
" " (2)..... $PbO(OH)_2$ (?)
Lead sulphate..... $PbSO_4$

In the above list the queries are used to indicate that authorities differ regarding the composition of the hydroxide or hydrate of lead.

Of all these substances, the only one that really showed metallic conduction was the peroxide of lead, and, in general, the difference of potential against zinc increased in the case of the oxides and hydroxides according to the quantity of oxygen in their composition.

The following conclusions are deduced from these and the previous investigations:

1. The phenomena in a secondary cell are sufficiently explained by the behavior of metallic lead, its sulphate and its peroxide, together with the gaseous ions, hydrogen and oxygen.

2. When a secondary cell is discharged, the metallic surface of the negative plate is converted into sulphate of lead, which partly passes into peroxide of lead. On the other hand, the peroxide on the surface of the positive plate is superficially converted into sulphate of lead.

3. When a secondary cell is charged, the sulphate of lead disappears from both negative and positive plates, and, finally, the positive plate consists entirely of pure peroxide of lead, whilst the negative plate consists entirely of lead and absorbed hydrogen.

It may be noticed that the latter part of statement three was, in a measure, suggested by a previous observation of Streintz, namely, that lead possesses in a marked degree the power of occluding hydrogen, the occlusion being apparently similar in character to that observed in palladium. This was shown by the study of the effect of current density upon potential differences.

A full account of this research by Streintz and Neumann may be read in the *Annalen der Physik und Chemie*, series 2, vol. xli., p. 97. And as bearing upon the same subject, we may recommend our readers to study in this connection the researches of Frankland on the chemistry of storage batteries, of which we gave some account in our issue for August 23, 1890.—*London Electrical Review.*

The Wenstrom Company.

We take pleasure in publishing the following communications:

To the Editor of Electrical Review:

Gentlemen:—We have had so many reports come to us from different sources that the Wenstrom Co. had been bought out by other electrical concerns, and so many rumors have been spread which have been detrimental to our interests and the credit of the Wenstorm Co., that we addressed a letter to Mr. Tunis asking him to put this matter right before the public.

We would be very much obliged if you would put this letter which we enclose before the public through the columns of your valuable journal.

Very truly yours,
Chadbourne, Hazelton & Co.,
A. H. Chadbourne.

Philadelphia, January 17th, 1891.

Office of the Wenstrom Consolidated Dynamo and Motor Company,
Baltimore, January 16th, 1891.

Messrs. Chadbourne, Hazelton & Co.,
General Agents Wenstorm Con. D. and M. Co.,
416-420 Walnut street, Philadelphia, Pa.

Gentlemen:—Replying to your favor of the 15th instant, in which you state that rumors have come to you from various sources that the Wenstrom Co. has been bought out by other concerns, I beg to say that you may emphatically deny all such reports.

The Wenstrom Co., as you know, have just completed one of the finest electrical factories in the world, and being possessed of many valuable patents, and having demonstrated the superiority of their generators and street car motors, are in a position to fill all orders promptly, and believe that any combination which could be suggested would be a hindrance rather than an assistance to them. You may assure your agents and customers that we are in an entirely independent condition, and are prepared to deliver goods promptly.

Truly yours,
The Wenstrom Consolidated Dynamo and Motor Company.
Signed, E. L. Tunis, *President.*

Plant Efficiency with Hedgehog Transformer.

A REPLY TO MR. STANLEY FROM MR. SWINBURNE.

To the Editor of Electrical Review:

Mr. Stanley's paper in the *Electrical Engineer* of December 10, calls for a reply from me. Mr. Stanley divides transformers into two classes, the closed circuit or "American" type, and the open or Gaulard and Gibbs type, the hedgehog being included in the Gaulard and Gibbs. I do not quite understand why the closed circuit transformer should be called American, it was not first invented by Mr. Stanley nor was it first made in America, and it was already well known in 1885. This point has, however, nothing to do with the main subject of Mr. Stanley's paper, except in so far as it invokes national prejudice in favor of the closed circuit. He says that in 1885, before adopting the closed circuit transformer, he considered the merits of the open circuit type, including the hedgehog. The hedgehog transformer, however, was not invented in 1885. Mr. Stanley assumes that the primary current of the hedgehog transformer does not decrease with the load, or that it decreases, at most, 20 per cent. This may be the case with the early form of Gaulard and Gibbs transformers, but is not true of the hedgehog. The exciting current at no load is about one-third of the full load current. Taking, now, Mr. Stanley's example, we may take a station with the full load output of 10,000 lamps and 10 engines and dynamos. Taking 95 per cent. as the full load efficiency of the transformers, whether open or closed, and omitting loss in leads, we have 525,000 watts supplied to the terminals of the dynamos. Assuming efficiencies of 90 per cent. for the dynamos and engines, we have 583,000 supplied to the pulleys and 648,000 watts indicated. If all the lamps are turned out, one engine and dynamo can run all the closed circuit transformers. There is then a waste of 25,000 watts in the iron, the waste in copper being taken as inappreciable; there is a loss of 5,800 in the dynamo and 6,500 in the engine, making a total waste of 37,400 watts.

Taking, now, the case of the hedgehog. At no load the loss in iron is about 5,000 watts, and three dynamos can supply the exciting current. As very little power is needed, it is not necessary to run three engines. Nine engines and seven dynamos are, therefore, shut down altogether, and two dynamos are left running with the engines, uncoupled by friction or other clutches, and one engine supplies the power. We thus have one engine driving one dynamo directly and two other dynamos running loose as motors and supplying the exciting current. The total loss is, then, 5,000 watts in the iron of the transformers, 17,400 watts in three dynamos and exciters and 6,500 loss in one engine, making total of 30,000 watts. So, even in this clumsy way, the loss in the hedgehog type comes out less than in the closed circuit type, instead of 7.6 times as great, as Mr. Stanley makes it. I must point out, however, that if the transformers had to be run all day with no load, a 50,000 watt engine would not be used to drive, as only 5,000 watts are used in the transformers.

This method is only one way of running open circuit transformers. We have not yet had any trouble from exciting current, and when we do, we will merely provide condensers to supply the exciting current. It is then necessary in the previous example to run one engine of 6,200 watts and one dynamo giving 5,000 watts on the terminals. The loss with the closed circuit transformers thus comes out six times as great as the loss with the hedgehog, instead of being about an eighth, as Mr. Stanley makes out. Even this comparison is not quite fair, as the efficiency of 95 per cent. for the closed circuit is higher than is generally obtained in practice. The Westinghouse Company, for instance, advertises the efficiency of three leading American makers as below 90 per cent. They except their own, but they may be biased with regard to it. There is no reason why they should have any monopoly of high efficiency in closed circuits, as any other maker can use good iron and follow the principles laid down in my British Association paper. I am quite aware, of course, that a scientifically designed closed circuit transformer can give 95 per cent. efficiency; but advocates of closed circuit transformers should do me the justice to admit that this high efficiency is not due to them. Until my paper was read at the British Association, in 1888, little was thought of the loss in iron. I there showed how closed circuit transformers should be designed to give 95 per cent. efficiency; and since then makers have reconsidered the proportions of the iron and copper in their transformers. As far as I know, nothing had been said before about proportioning the iron so as to get small loss by hysteresis. The high efficiency closed circuit transformers have been produced by following the lines indicated in my paper. I am, therefore, hopeful that electricians will eventually go still farther and fully realize the value of the hedgehog transformer.

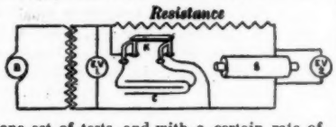
Jas. Swinburne.

Wimbledon, England, Jan. 3d, 1891.

The Rise of Potential Difference in the Deptford Mains.

W. E. Ayrton, writing for the London *Electrician*, says:

I am glad to see, from Mr. Glazebrook's article in the *Electrician* for December 26, that he holds the same view as that given by me to my students some little while ago on this subject. This view was, that when a transformer is used at Deptford to transform up the volts and another one at London to transform them down, the mere fact that the cable connecting these transformers had capacity was sufficient to cause the potential difference at London to be higher than the potential difference at Deptford. In connection with this suggestion some of the students at the Central Institution made a number of experiments last term under the superintendence of Dr. Sumpner and Mr. Mather. The annexed figure explains the arrangement of apparatus used by them for



one set of tests, and with a certain rate of alternation, etc., they found on pressing down the double key, K, by its wooden cross-bar so as to connect the two coatings of the condenser with the two terminals of the secondary coil of the transformer, that while the potential difference measured by voltmeter E_1V (volts at Deptford) went up about one per cent., the potential difference measured by the voltmeter E_2V (volts at London) went up over five per cent. On raising the key, the potential difference at each end of the circuit went back to its original value, showing that the effect observed in this experiment was solely due to the addition of capacity to the mains.

As the secretaries of the Physical Society tell me that they intend devoting one meeting early this next year *exclusively* to the subject of transformers, I will confine myself on the present occasion to the above brief description of this one experiment.

Thomson-Houston and Brush Representatives Meet in Cleveland.

A number of directors of the Brush Electric Company and the attorney of the Thomson-Houston Company, says the Cleveland *Plaindealer*, were at the The Hollenden, notably attorney F. P. Fish, of the Thomson-Houston Company, and director J. L. Bartlett, of the Brush Company. The party originally consisted of Messrs. F. P. Fish, J. S. Bartlett, J. Baker and O. T. Crosby, all of Boston. All except the first named are stockholders in the Brush Company. Concerning the object of their presence in this city, Mr. Bartlett said:

"I came here to attend the annual meeting of the stockholders of the Brush Company, and I believe the other gentlemen just happened to meet here on other business. Mr. Fish is also here in the interest of his company and will remain until the meeting."

"Is there anything new in the deal?"

"No, there is nothing. If there is any news it will not come out until the annual meeting is held, when the officers of both companies will no doubt be glad to give the newspapers any changes that are made."

"Is there any danger that the Brush Company will cease to exist; that it will be merged in the Thomson-Houston, so as to lose its name?"

"I don't think so. The Brush Company has considerable prestige and there is no reason why its name should be abandoned."

"Will the changes throw any men out of employment at the Brush plant in this city?"

"No, I don't think they will. On the contrary, I think the works will be so run that more men will be needed; but all these things will become known after the annual meeting. There is nothing certain and anything I might say would be only surmise."

Electric Light News

—— Mayor Liddle has vetoed a resolution of the common council to bond the city of Lockport, N. Y., for $40,000 for an electric light plant.

—— By the bursting of a steam pipe in the Sansome street station of the Philadelphia Edison Illuminating Company, three men were badly scalded.

—— The stockholders of the Narragansett Electric Lighting Company, of Providence, R. I., have voted to increase the capital stock to $200,000.

—— The Union Electrical Construction Company, of St. Louis, assigned to Paul F. Coste for the benefit of creditors. Assets $5,500; liabilities unknown.

—— The Powelton Electric Company, of West Philadelphia, which was awarded the contract for lighting that section of the city, got its plant in running order the evening of the 9th.

—— The East End Electric Light Company, of Pittsburgh, has begun the use of coal. They will consume 300 bushels daily. The natural gas has heretofore cost $1,800 per month.

—— The Wells Electric Construction Company, of Osceola, Pa., and who have a partially completed electric plant at Milton, made a general assignment for the benefit of their creditors, January 14.

—— The annual report of the Brooklyn Edison Illuminating Company shows its capital stock as $1,500,000, of which $1,209,075 is paid up, $789,075 in cash and $420,000 for the purchase of patent rights. Liabilities are named as $71,000.

—— In the foyer of the Metropolitan Opera House, in this city, has been placed a very complete and perfect model of this immense theatre. It is illuminated by electric lights and is designed to assist purchasers in choosing their seats.

—— It is stated in Boston that the Thomson-Houston Company will have on Feb. 1, assets against its common stock of $50 a share; also that there has been earned on Thomson-Houston stock and paid in cash something like $40 per share.

—— The New York Gas Commission awarded contracts January 16th, for lighting 829 street lamps by electricity for the ensuing year. The cost will be 40 cents a lamp a night for nearly all except 19 in the upper district, which will cost 50 cents.

—— The Northern New York Electric Light Company is rapidly reconstructing its lighting system in the Twenty-third ward, where it was cut down last year by order of the Board of Electrical Control for failure to comply with the regulations of the board.

—— The making of incandescent lamp bulbs at the Corning, N. Y., glass works, has become quite an industry. Two hundred and fifty men and 60 girls are employed at this class of work. The girls wrap the bulbs in paper for shipment. Each bulb blower makes 1,000 bulbs a day and 100 men are engaged blowing them.

—— The suit of John Chandler against the Plainfield, N. J., Electric Light Company to recover the value of his trotting horse Rambo, which was killed by coming in contact with one of the company's "live" wires, has been settled by the payment by the company of nearly the full amount of damages claimed. Rambo was valued at $3,000.

—— The new electric light station at Norwalk, Conn., will be built by the Berlin Iron Bridge Company, of East Berlin, Conn., from their own designs. The building will be 60 feet by 70 feet and will have a two-ton traveling crane extending the whole length of the building. The construction will be entirely of iron, fireproof, and is expected to be a model station of the kind.

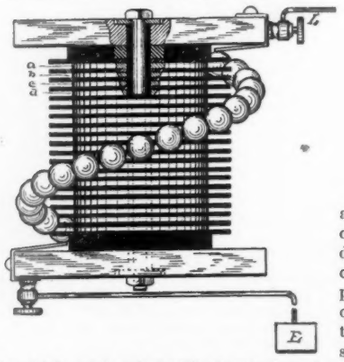
PROGRESSIVE ELECTRICAL INVENTIONS.

CARBON BRUSHES.

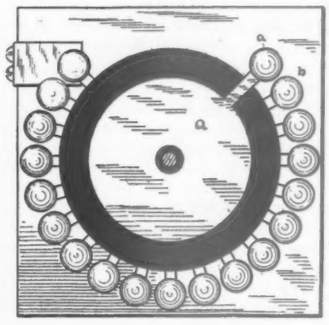
One of the interesting details in which improvements have been made with motors and dynamo machines of late years, has been in the line of brushes. One of the first steps in this direction was the use of carbon blocks, plated with copper on about half their surface, and placed edgewise on the commutator and held in contact by spring pressure. A recent improvement on these brushes, invented by A. S. Cook, of Cambridge, Mass., is said to materially reduce the amount of wear on the commutator and waste of the carbon, and to produce noiseless contact. The improvement consists in treating a block of carbon plated with copper over a little more than half its surface by immersing it red hot in a mineral lubricating oil, the quantity of oil in which the block is immersed not being sufficient to suddenly cool the carbon. The heat drives out a large portion of the air and gases occluded in the interstices of the carbon block, and permits them to be replaced by oil. The block is permitted to remain 10 or 15 minutes, and is then withdrawn and allowed to cool. It is claimed that one of these brushes will last for months, and that the surface of the commutator is apparently not worn at all. The contact surface of the brushes is beautifully polished after a short use, and the conductivity apparently improved, contrary to what might be expected. Heat is an essential element of the treatment, for if the carbon be soaked cold in oil, it is practically worthless. One of these brushes is illustrated in the accompanying engraving.

LIGHTNING ARRESTER.

Where a number of breaks are made in an electric circuit or a number of discharge spaces are successively placed to be traversed by a discharge, the total distance represented by the sum of the spaces or breaks, can be made much greater than the striking distance of the discharge between two plates where a single break only exists. Advantage has been taken of this principle by Prof. Elihu Thomson to construct an improved lightning arrester. Where a single pair of plates has been used when the distance has once been bridged by an arc, as by a flash of lightning, the arc is much more readily maintained by the current of the line to which the arrester is attached, if the current be of high potential, than it would be if the number of striking spaces were multiplied and arranged in series, so as to require the formation of a number of arcs between successive bodies of cold metal to permit the line current to leak to earth. One of the devices employed by Professor Thomson is illustrated in the accompanying engraving,



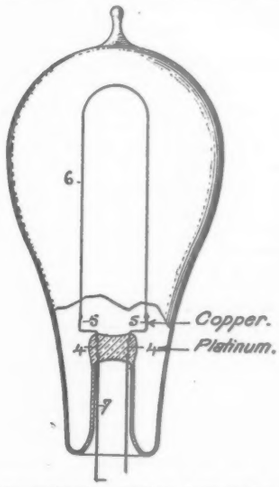
in which a series of metallic plates *a*, *b*, *c*, *d*, separated by insulating washers, such as hard rubber; each washer projecting a little distance outside of the metallic plates, are held together in a suitable frame-work. Each plate, as *a* (see plan view) is provided with a lateral projection and carries a discharge terminal, such as a ball, which lies within a small distance of the succeeding ball, as *b*, of the series. At one end of the series is a connection to the line, as at L, and at the other a connection to the earth. The effect of arranging the plates as shown is to give each one a certain static capacity and permit the discharge points or balls to be adjusted a desired distance apart by simply swinging the plates around circularly so as to arrange the discharging points in a spiral fashion around the column of plates. The sum total of the spaces that must be jumped by the discharge is largely in excess of the



striking distance of an ordinary lightning arrester, or several times the largest possible space which could be used with safety to protect a dynamo against injury from induction discharges, and the aggregate length of space may be varied in accordance with the increased potential of the line, using, say, for each 30 or 40 volts of potential on line, one discharge space. By thus splitting up the whole space traversed, a sudden discharge coming over the line, even of moderate power as to striking distance, has no difficulty in getting to earth, as it breaks down disruptively the several spaces in succession, the spark jumping from one plate or ball to the next, destroying the electrostatic resistance of the space jumped and sending the discharge in full force to the next space.

SAVING PLATINUM IN INCANDESCENT LAMPS.

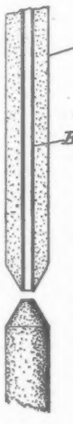
The scarcity and increase in price of platinum renders any improvement by which the amount of platinum required as leading-in conductors for incandescent lamps one of considerable importance. Platinum seems to be the only metal by which a stable vacuum can be maintained when it is used



as the conducting medium between the circuit terminals and the filament of an incandescent lamp; this valuable quality is an incident of its co-efficient expansion which is practically the same as that of glass. In order to form a support of sufficient stability the size of the leading-in wires must be of sufficient cross section, otherwise they might be drawn to a hair-like fineness. Mr. Edison has recently patented an improvement by which the amount of wire may be reduced without sacrificing the firmness of the support. He finds that wires of copper, iron, silver, nickel and other metals and some alloys having a greater co-efficient of expansion than platinum, can be sealed into the glass, but on cooling they contract sufficiently to permit air to pass into the vacuum, although they will still be held mechanically rigid by the glass. He, therefore, uses as leading-in wires two metals, one section being of a metal having substantially the same co-efficient of expansion as glass, namely, platinum, the other being a different and cheaper metal, both metals being sealed into the glass. The seal remains perfect at the platinum sections, which renders it immaterial whether the copper or other wire contracts away from the glass, the contraction being so slight that the stability of the support is not interfered with. By this improvement the size of the platinum wire is only limited by electrical conditions, and it can be made as fine as one five-thousandth of an inch in diameter for a lamp taking one-half ampere of current. The bit of platinum wire used need only be long enough to make it practicable to attach the other section of wire to it by fusion, and in practice not more than one-eighth of an inch is required. Copper is the preferable metal used in conjunction with the platinum, and may be of such a size as to give the same mechanical support to the filament as has heretofore been afforded by the thick wires of platinum. A lamp provided with the improvement is illustrated in the accompanying engraving.

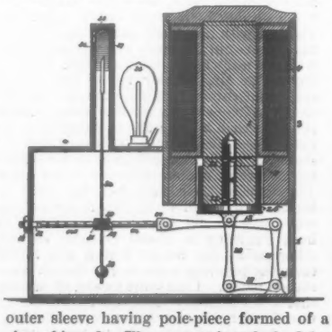
ARC LIGHT CARBONS.

Arc light carbons of the present day have reached such a high state of perfection, when compared with the carbons used in the earlier history of electric lighting, that it seems difficult to improve them. The hissing and sputtering noise of the arc lamp, however, indicates that somewhere in the lamp there is a chance for improvement. Mr. Burton B. Ward, of New York, has recently patented a carbon which it is claimed obviates these annoyances. The carbon is illustrated in the accompanying engraving, and as indicated, is provided with a longitudinal bore or passage at or near the center, the wall of which is covered with a thin film or layer of silicate of soda or silicate of potash. This material is applied in the form of a solution, a few drops being placed at one end of the bore and distributed over the interior surface by means of an air-blast through the bore. Upon drying, the wall of the passage is lined with a uniform film of the silicate. In the use of the carbon this film vaporizes in the arc as the carbon burns away and produces a vapor of considerable conducting capacity, preventing the breakage of the arc with a current of low voltage. The thickness of the layer is much less in practice than indicated in the engraving.



VOLTMETERS.

We illustrate herewith an improvement in voltmeters recently patented by Edward Weston, of Newark, N. J. The device comprises a bell magnet composed of an outer sleeve 5 and the central core 8, the



outer sleeve having pole-piece formed of a ring of iron 9. The magnet is polarized by a coil 11 and a dense magnetic field is created between the pole-pieces 8 and 9. The end of the core is recessed and provided with jeweled bearings supporting a rod carrying a metallic cylinder 3 on which is wound a coil of very fine wire. The coil of wire is placed in series with the coil 11 so that the current to be measured passes through both coils. The metallic cylinder is supported upon a bell crank lever, one limb of which is connected with the cylinder by a link 26 and the other of which is connected by a link with a spiral spring 14, upon which is mounted an indicating needle 34, the point of which is adapted to sweep over an arc in a housing formed by glass panels 36, 37. An incandescent lamp is mounted behind these panels so as to illuminate the marks which indicate the readings. When the current of which the voltage is to be measured passes through the coils its effect is to cause the coil 25 surrounding the metallic cylinder to move longitudinally along the core 8, thus creating a tension on the spiral spring and deflecting the indicator.

Electrical Visual Indicators or Sporting Bulletins.

A simple electrical and mechanical organization to effect the automatic bulletining of news or events concurrently with their taking place, has been long sought for by inventors and would certainly be a desideratum. A practical system for accomplishing such results must plainly approach, as far as is possible, the simplicity of the primary or fundamental system of telegraphy of Morse, and, like it, be capable of relaying and repeating to great distances, be free from fine adjustments and delicate mechanism, and, what is of the greatest importance from a commercial point of view, operated over a single line wire. Mr. S. D. Mott, of Passaic, N. J., has had patented to him, in the United States and Europe, a system having these qualities to a marked degree which he has reduced to practice in a popular and pleasing way, that of the reporting of races and national games, the former giving the visual report of the results of races of any kind and the latter graphically indicating as a clock indicates the time of day, the important features and events of a base ball game. The same electrical organization may be adapted to other games.

The system materially differs from the telegraph in that no receiving operator is required, the dials receive and publish the transmitted intelligence at one and the same operation, repeating it through any reasonable number of widely separated instruments; one operator taking the place of 101 operators when a ball game or horse race, for instance, is being reported from the grounds to 100 different localities.

It is claimed for this instrument that it is very much cheaper than the stock ticker, simpler electrically and mechanically, and by no means so liable to derangement in working. That it can be operated over very much longer lines, needing no attention such as winding, supplying with tape, etc., only an occasional inspection by those having them in charge. The perfected instrument constructed by Mr. Mott he has given the general outline or shape of a base-ball diamond. At the base of the diamond shaped dial, or in proximity to the instrument, is pinned a programme of the day's game. The contestants are printed in colors with corresponding colors appearing upon the dial through openings in the dial face. The following points or main features of the game are clearly indicated, the contestants' time, date, place of game, umpire, battery, position of men in field, the inning being played and the side which has the inning and number of outs in the inning, the man at the bat and number of strikes called on him, also the number of balls called. It shows how the last man went out, whether by fly, foul, assist, strikes or sacrifice hit. The base runs, a home run, base on balls, stolen base, or base on errors; the total score and the score by innings.

The cardinal feature of this invention is the ingenious form of alloy which may also be used as a repeater, devised by Mr. Mott for this class of work. The method of synchronizing the instruments one with another, as also the local magnets through the system, enabling the operator at his will to bring the apparatus controlled by the local magnets back to the zero or neutral point.

The Electrical Railway Between Vienna and Buda-Pesth.

To the Hungarian Ministry of Commerce there has been lately submitted the prayer for a concession for a project which, if carried out, will form an epoch in the history of electric railways, says a correspondent of our London namesake.

The project in question is nothing less than the construction of an electric railway between Vienna and Buda-Pesth, a distance of about 250 kilometres, for which purpose there are to be erected six electric generating stations, so that each station will effect the working for a distance of about 20 kilometres in each direction. Concerning the details of this magnificent project, the execution of which is still a question of the future, and the practicability of which now forms the subject for the investigation of experts at the Ministry, the following communications have been made public:

The projected line is for the first to undertake merely the passenger traffic, and every three hours an ordinary and an express train will start alternately, with an average speed of 120 kilometres hourly, so that the journey from Buda-Pesth to Vienna or back again will not take more than two or two and a half hours. The express trains will be exclusively reserved for the traffic between the two termini, and will thus subserve communication between the two capitals of the monarchy. The ordinary passenger trains will stop at the intermediate stations. The fare between Vienna and Buda-Pesth is estimated by the projectors at about three florins, and that the journey on this electrical line will not merely be three times as rapid, approximately, as that by an express on the steam railway, but it will be out of all proportion cheaper than the present greatly reduced scale of fares.

The projected line, according to the statements of the promoters, will have a broader gauge than the present normal railway gauge, and will be laid with "Goliath rails," and the crossings will be effected either on viaducts or through tunnels. For greater security, an iron grating, of about one metre in height, is to be erected on each side of the track.

The cost of the line, according to the preliminary estimate of the projectors, is given as about 38,000,000 florins. It was stated at first that the Commercial Bank of Pesth had undertaken to finance the undertaking. This assertion, however, is contradicted by qualified authorities, whence the financial phases of the question, and consequently the entire execution of this very interesting project remains an open question, not easily to be answered, if we consider the colossal sums which will be required.

The application for a concession has, in other respects, not met with any favorable treatment, and no forecast of its destiny is so far possible. Public opinion is at present very skeptical as to the success of the project. The subjoined extract from a local paper may serve to show the view here prevailing:

"The advocate, Dr. Julius Kepes, lately presented to the Minister of Commerce a petition for a preliminary concession for a double-line electric railway from Buda-Pesth to Pressburg, or to the Hungarian boundary. The line would run in part parallel with the line of the State railway. Up to the frontier it would include 38 stations, passing from Buda-Pesth *via* Pillis-Coaba to Gran, crossing there the Danube, and through the so-called Csallo-Köz to Dnua-Szeidahely and thence to Pressburg and over the boundary, where a bridge would have to be thrown across the Danube. Concerning the prolongation of the railway to Vienna, application would be made to the Austrian Minister of Commerce. Or, if considered preferable, the Hungarian Minister of Commerce might negotiate with the Austrian government. The electric leads are to run neither on the line nor above it, but on the rails. The normal railway gauge, 1.435 metres, would not be sufficient for the speed intended, and a gauge of two metres is considered necessary. To prevent misadventures, the track will be fenced in for its entire length, with an iron grating one metre in height. The time between Buda-Pesth and Vienna is to be one and one-half (? 2½) hours, and the fare one to three florins, according to the class of the carriage and the kind of train. Express trains are to stop only at the two termini, but the mail trains will call at intermediate stations. A train will be despatched in each direction at intervals of three hours. If the traffic increases, these intervals will be reduced to 10 minutes. If the electric conduction is effected by the rails themselves, they must be insulated from the ground. All the details show that the execution of the undertaking will be extremely costly. The projectors estimate the expenditures at 50,000,000 florins. The attitude taken by the Ministry of Commerce with respect to the project is one of great reserve. This appears from the fact that a deposit of 20,000 florins has been required from the applicants before a preliminary concession, *i. e.*, permission to study the proposed route, can be granted. This sum has not yet been deposited. To the application there was appended an opinion of the American electrician, Thomson, and of Professor Straub (of Buda-Pesth.) The former is said to have declared that no serious technical difficulty stood in the way of an electric railway over a distance of 250 kilometres, and the highest attainable speed might reach 300 kilometres per hour. The opinion of Straub vouches the question whether electric traction is practicable on an incline of 1:20, such as occurs on the projected track, and how many electric stations will be needed. Straub expresses himself with caution. He answers the first question in the affirmative, and considers that an incline of 1:20 will not interfere essentially with the speed of the traction if there are a sufficient number of carriages provided with strong wheels. He considers that as a rule 60 to 75 kilometres hourly can be managed with the electric express locomotive, which speed can, if needful, be increased to 80, 90, or even 105 kilometres. He thinks that even 180 kilometres hourly would not be impracticable. Bell, Crosby, and other electricians have pronounced electric traction practicable, even on long lines. As regards the inclines, he refers to the line Madeline le Vallois, where such an incline is managed without difficulty. His opinion concludes with the suggestion that experiments should first be made with a distance of 50 kilometres, and that the line should first be only constructed as far as Gran. The Minister Baross is said to have read the documents with great attention. But he evidently entertains scruples, as appears from the unusual demand for a deposit. The advocate, Kepes, has discussed the project with several engineers and contractors at Buda-Pesth, but they all decline to participate in its execution. The report that the concession had been applied for on behalf of a firm of contractors, of Berlin, is declared to be unfounded."

Electrical Stage Effects.

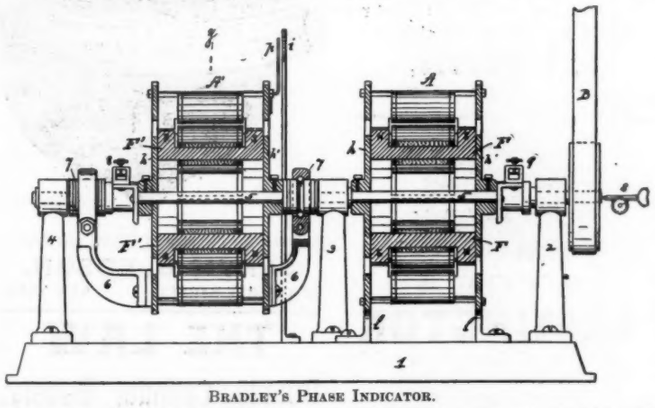
Quite an electrical novelty was produced on the boards of the Amphion theatre, Brooklyn, last week, by the Hattie Harvey Company in the play "Jessie Daw."

The novelty was in the shape of electric canes and umbrellas carried by the performers in the "Garden Scene" in the play. These canes and umbrellas had small incandescent lamps in the handles which flashed at given signals, and produced very novel and beautiful effects. The lamps were operated by Nassau capsule batteries concealed in the canes.

The canes and umbrellas were manufactured expressly for this performance by the Nassau Electrical Company, of this city.

Phase Indicator.

In operating with alternating currents, when two or more currents, as in motor work, differing in time periods, are used, it is very desirable to know the exact phase difference of the two currents. A machine recently designed by Charles S. Bradley, of Yonkers, N. Y., solves the difficulty in a very ingenious way. Mr. Bradley's device is illustrated in the accompanying engraving, in which F and F^1 are field-magnets rigidly mounted upon a rotating spindle supported in suitable bearings. These field-magnets are made up preferably of ten straight magnets, the poles of which alternate in position. Both field-magnets F and F^1 correspond as to the circumferential position of their component poles. Surrounding each is a multipolar structure, one of which, as A, is rigidly fixed to the base plate and the other of which is supported upon swinging bearings 6, 7, and provided with an indicating pointer *p* adapted to swing over an arc of a circle in front of a scale *s* supported upon the base plate. The coils of the armatures A and A^1 are in series relation. The field-magnet coils F and F^1 are placed in circuit with a source of constant current by means of the brushes 8 and 9. When it is desired to ascertain the difference in phase between any two alternating currents, one of them is taken at random and connected in circuit with the armatures A and A^1. An auxiliary motor operating on belt B is then started and raised in speed until the field-magnets are synchronous with the alternating generator. The machine A then acts as an alternating current motor and will remain in synchronism although there will be a little lag due to friction and air resistance. The motor on belt B is kept in action and raised in speed until the pointer *s* stands opposite zero on the scale. The friction is then compensated for and the machine truly synchronized with the generator. The armature A^1 is then disconnected from the alternating circuit, A remaining connected, and A^1 is connected up with the circuit carrying the current differing in phase. Immediately the armature A^1 swings on its ball bearings so that its pointer *p* takes a position at some point intermediate between the zero and the end of the scale. This results from the fact that the waves now circulating through the coils of A^1 are a little later in point of time although they have the same periodicity as the waves which circulate through the coils of A, and as the coils of A are synchronous in the time of presentation to their field-magnet poles with the alternations in the circuit, the deflection of pointer *p* must indicate the lag or difference in time period between the two alternating currents. A speed indicator *s* indicates the number of revolutions per minute, and this multiplied by one-half the number of pole-pieces gives the number of full periods or alternations which take place in the circuit per minute.



BRADLEY'S PHASE INDICATOR.

The Baxter Electric Motor Company has elected these directors for the ensuing year: E. G. Hight, Jesse Hilles, George C. Jenkins, W. H. Whitridge, B. F. Deford, B. F. Smith, A. H. Jackson, B. M. Greene and D. T. Morton. The directors organized by electing E. G. Hight, president; Jesse Hilles, vice-president, and R. B. Griffin, secretary and treasurer.

ELECTRIC CLUBS.

New York Electric Club.

"The Electric Railway" at the Electric Club.—The next regular meeting of the Electric Club will be held Thursday evening, January 22, 1891. Mr. Franklin Leonard Pope, of New York, will deliver the address. "Notes on the Electric Railway, Historical, Statistical and Technical," is the timely subject of Mr. Pope's paper. The lecture will begin at 8.30 o'clock, and will probably be delivered to one of the largest audiences ever assembled in the Club house. A business meeting of the Club, as heretofore announced, will be held at 8 o'clock.

A number of new applicants for membership are awaiting the action of the committee.

Out-of-town visitors during the week were as follows: Henry H. Peck and John M. Peck, New Haven, Conn.; Edw. Cannon and H. W. Shurtz, Portland, Ore.; W. C. McIntire, Philadelphia; Lieut. F. B. Badt, Chicago; H. J. Leslie, London, Eng.; Ferdinand A. Wyman, Boston.

Mr. T. P. O'Connor, the Irish M. P. and London journalist, who was recently a guest of Joe Howard, at the Electric Club, was entertained as a guest by the famous Clover Club, of Philadelphia, the other night. Mr. O'Connor was introduced by his friend Major Moses P. Handy, the president of the Club, in a very sarcastic speech. Mr. O'Connor stood the guying of his hosts in a truly imperturbable journalistic manner and evened up matters pretty well by letting fly the following: "Boys, you make me homesick. I have never witnessed such disorderly scenes outside the House of Commons."

Harvard Electric Club.

G. S. Curtis, '92, was elected secretary of the Club at its last regular meeting, and T. Hoppin, '93, chosen to fill a vacancy in the executive committee. Dr. Wilson was chosen an honorary member. An interesting paper on "A Model Central Station" was read by G. T. Page, '92.

BOOK NOTICES.

"Transactions of the American Institute of Electrical Engineers," for November, 1890, has been received.

The programme and souvenir of the annual ball of the Boston police force contains an interesting account of the adoption and maintenance of the police signal system in that city.

The Rockford, Ill., *Gazette*, opened the new year with a special illustrated edition bound in a cover. A historical sketch of the city was given. Among the prominent men who had their portraits published was Mr. John Barnes, secretary and treasurer of the W. F. & John Barnes Company, whose products are so well known to all electrical manufacturing companies.

The *Amateur Electrician* is a little monthly about the size of *Printer's Ink*, which it very much resembles. It is published in Ravenswood, Cook County, Ill., a suburb of Chicago. It will disseminate the "first principles of electricity."

The *Canadian Electrical News and Steam Engineering Journal* comes from Toronto and Montreal, Canada. It is the outgrowth of a Canadian milling paper, and has wisely decided to cater, in the future, to the two progressive industries indicated in its title. The *News* will appear monthly.

We have received from the Electrician Printing and Publishing Company, London, "May's Popular Instructor for the Management of Electric Lighting Plant." It is the first 1891 electrical book that has come to us. The work is by Dr. Oscar May, an electrical engineer of Frankfort-on-the-Main, Germany. It is pocket size and has 86 pages. The book is designed as an elementary instructor to owners and tenders of electric lighting installations. Instructions are succinctly and aptly expressed. As a first book, it is a splendid thing for a steam engineer who may some day have to run an electric lighting plant.

The stockholders of the Lynn & Boston Railroad Company have voted to petition the Massachusetts railroad commissioners for authority to increase the capital stock by an amount not exceeding $500,000, for expenses to be incurred in adopting electricity as a motive power.

KINDRED INTERESTS

The Elektron Manufacturing Company, Brooklyn, have issued a new price list of Perret dynamos and electric lighting apparatus.

Charles T. Jaeger, 200 East Kinzie street, Chicago, is making a specialty of glass blowing for scientific purposes, including an improved glass exhaust pump.

The Leclanche Battery Company have removed their offices and factory from 149 West 18th street, to 111–117 East 131st street, this city, where with greatly increased space and facilities for manufacturing they will be able to fill orders without delay.

The Cleveland Aluminum Company is making a specialty of aluminum castings of all kinds. The demand for this material is constantly increasing, and this company is building up an extensive business in aluminum castings, sheets, wire ingots and aluminum bronze.

The Central Electric Company will shortly present to the public a very handsome and complete catalogue of electrical supplies. The page will be 7½ x 11 inches, printed on heavy enameled book paper, and will be a fine sample of printing and bindery work, as well as an electrical encyclopedia. Each article will be described by a trade word, which will greatly facilitate ordering supplies, and also save considerable expense when orders are sent by telegraph. The book will appear inside of 30 days.

A True Statement About Advertising.

Well-written advertisements are more than 50 per cent. news. Assertions can be made and sustained that there are cases on record where there has been more real brain matter expended on the making up of an advertisement than in the construction of many pages which rest under the dignified name, literature.—*South Bend, Ind., Tribune.*

FINANCIAL.

Closing quotations of electric stocks, from F. Z. Maguire & Co., Electrical Securities, 18 Wall street, N. Y., Saturday, January 17, 1891. New York, Boston and Washington Stock Exchanges. Pittsburgh closing January 16.

NEW YORK.	
Western Union Telegraph Co.	79
American Telegraph & Cable	83
Central and South American	*145
Mexican	*210
Commercial Cable Co.	104
Postal Telegraph Cable	39
Edison General Electric Co.	88
" " " Deferred	
Consolidated Electric Light	
Edison Electric Illuminating Co.	70
United States Electric Light	30
North American Phonograph	
BOSTON.	
Thomson-Houston Electric Co.	42½
" " " Preferred	25½
" " " Series C	
" " " Series D	5½
" " International Co.	
" Welding Co.	
" European Welding Co.	
Ft. Wayne Electric Co	11
TELEPHONE:	
American Bell	204
Erie	49
New England	51
Mexican	.70
Tropical American	
MISCELLANEOUS:	
Edison Phonograph Doll	1
WASHINGTON.	
Pennsylvania Telephone	25
Chesapeake and Potomac	*62
American Graphophone	10
United States Electric Light (Wash'ton)	140
Eckington and Soldiers' Home Electric Railway	55
Georgetown and Tennallytown	51
PITTSBURGH.	
Westinghouse Electric Mfg. Co.	5⅝

* Ex. Div.

IF YOU have anything pertaining to electric machinery you want to sell, send us the description.

IF YOU want anything pertaining to electric machinery, send us your inquiries.

FRANK RIDLON & CO.,
Dealers in New and Second-Hand
Electric Light & Power Machinery,
196 SUMMER STREET, BOSTON.

PAISTE CHINA SWITCHES.
HANDLE, CAP AND BASE,
Made of Ivory Colored China.
JUST THE THING FOR FINE RESIDENCE INSTALLATIONS.

PRICES AWAY DOWN ON ALL
PAISTE SPECIALTIES.
H. T. PAISTE,
1201 Market Street,
PHILADELPHIA, PA.
THE PAISTE SPECIALTIES
KEPT IN STOCK AND FOR SALE BY ALL PROMINENT SUPPLY HOUSES.

WANTED.—Position as electrical engineer or representative of electric company (railway preferred), or as superintendent of electric street railway company. Four years' experience in electric business.
Address, ELECTRICAL ENGINEER,
Care of ELECTRICAL REVIEW, N. Y.

MAP OF THE UNITED STATES.

A large, handsome Map of the United States, mounted and suitable for office or home use, is issued by the Burlington route. Copies will be given free when it can be done without expense for transmission, or they will be mailed to any address, on receipt of six cents in postage, by

P. S. EUSTIS,
Gen'l Pass. Agent, C., B. & Q. R. R., Chicago, Ill.

THE REMINGTON
has set the copy for writing machines for 15 years.
It is to-day the
STANDARD
and expects in the future, as it has in the past, to lead all others in adding improvements to what will always be the true model of a
TYPEWRITER
Wyckoff, Seamans & Benedict,
327 BROADWAY, NEW YORK.

PATENT PERFORATED
ELECTRIC
LEATHER BELTING
MANUFACTURED BY
Charles A. Schieren & Co.,
45, 47, 49, 51 FERRY ST.,
COR. CLIFF ST.

BRANCHES:
BOSTON, 119 HIGH STREET.
PHILADELPHIA, 226 NORTH 3d STREET.
CHICAGO, 46 SOUTH CANAL STREET.

Address, for Circular of Styles and Prices,
JARVIS B. EDSON,
87 LIBERTY STREET, NEW YORK.

THE LAW
Double Cylinder Battery.

Surface of negative element and quantity of solution double that found in any other open circuit cell.
Weigh carefully these advantages.

Its sale has steadily increased for ten years.

LAW TELEPHONE CO.,
Sole Makers,
87 JOHN STREET, NEW YORK.

ELECTRIX SWITCH.

ELECTRIX SPECIALTIES.
Endorsed the World over by Users.
Simple. Reliable. Indestructible.
DEALERS REPORT QUICK SALES.
CORRESPONDENCE INVITED.
THE STAR ELECTRIX CO.,
1320 Wallace St., Philadelphia, Pa.

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENTS OF THE UNITED STATES WERE ISSUED ON JANUARY 13, 1891.

444,416 Electric motor; William A. Anthony, Manchester, Conn.

444,424 Electric light support; Alfred Dawes, Chelsea, Mass.

444,433 Independent electric clock; Emil G. Hammer, Brooklyn, N. Y.

444,452 444,453 Electrical sporting indicator. 444,454 Racing indicator; Samuel D. Mott, Passaic, N. J.

444,461 Device for inserting branch lines on mechanical telephone lines. 444,462 444,463 Mechanical telephone exchange. 444,464 Molecular sound resonator; Geo. F. Shaver, New York, N. Y., assignor to the Shaver Corporation of New Jersey.

444,466 Electric lamp bracket; Thos. C. Smith, Philadelphia, Pa.

444,471 Carbon for arc lights; Barton B. Ward, New York, N. Y.

444,472 444,473 Electric arc lamp; Barton B. Ward, New York, N. Y., assignor to the Electric Construction and Supply Co., same place.

444,477 Conduit for electric wires; Alexander P. Wright, Boston, assignor, by direct and mesne assignments, to Arthur Lord, trustee, Plymouth, Mass.

444,479 Electric car controlling device. 444,480 Electric railway car. 444,740 Electric railway; Edw. M. Bentley, New York, N. Y.

444,482 Electric hand-setting mechanism for clocks; Wm. W. Bradley and Williard N. Packer, Canton, O.

444,486 Dynamo electric machinery; Justus B. Entz, New York, N. Y.

444,512 Electric locomotive; Montgomery Waddell and Justus B. Entz, New York, N. Y.

444,530 Leading in wire for incandescent electric lamps; Thos. A. Edison, Llewellyn Park, N. J.

444,539 Electric railway car; Lawrence A. McCarthy, Brooklyn, N. Y.

444,552 Electric indicator. 444,553 Method of controling currents upon electric circuits; John Hopkinson, Hohnwood, England, assignor, by mesne assignments, to the Westinghouse Electric and Mfg. Co., Pittsburgh, Pa.

444,566 Current collecting device for electric railways; Rudolph M. Hunter, Philadelphia, Pa., assignor to the Thomson-Houston Electric Co. of Connecticut.

444,567 Incandescent lamp socket; Geo. R. Lean, Boston, Mass., assignor to the Bernstein Electric Co., Portland, Me.

444,587 Regulator for dynamo-electric machines; Royal E. Ball, New York, N. Y.

444,597 Electric magnetic massage kneader; David Lichtenstadt and Charles Lichtenstadt, Chicago, Ill.

444,599 Electric appliance for trusses; Alva Owen, Chicago, Ill.

444,600 Magneto bell; William R. Patterson, Chicago, Ill., assignor to the Western Electric Co., same place.

444,640 Electric elevator; Norton P. Otis and Rudolph C. Smith, Yonkers, N. Y.

444,678 Lightning arrester; Elihu Thomson, Lynn, Mass., assignor to the Thomson-Houston Electric Co. of Connecticut.

444,687 Conduit inspector; Josiah L. Blackwell, New York, N. Y.

444,700 Automatic signal for railway crossings; Alvah W. Hall New York, N. Y.

444,706 Electric gas lighter; Thos. W. Lane, Boston, Mass., assignor to the Electric Gas Lighting Co. of Maine.

444,707 Rheostatic switch; Joseph H. Lehman, Philadelphia, Pa.

444,780 Telephone annunciator or indicator; Geo. R. Lawrence, Manteno, assignor of one-half to Chas. H. Oakwood, Danville, Ill.

444,791 Phase indicator for alternating currents; Chas. S. Bradley, Yonkers, N. Y., assignor to the Fort Wayne Electric Light Co., Fort Wayne, Ind.

444,794 Brush for dynamos; Almerin S. Cook, Cambridge, Mass., assignor to Hosea W. Leach, trustee, same place.

444,803 Potential indicator. 444,804 444,805 Electrical measuring instrument; Edw. Weston, Newark, N. J.

The Electrical Commissioners of the District of Columbia invite communications from firms interested in electric cables, conduits, subways, etc. Also upon the subject of municipal electric lighting, electric transmission of power, etc. Communications received until March 1, 1891. Personal interviews cannot be granted at present.

Address, ELECTRICAL COMMISSION,
Room 30, District Building, Washington, D. C.

RAILWAY FEEDER-WIRES.

Experience has demonstrated the necessity for the ***Best Insulation*** on Feeder-Wires.

THE BEST IS NOT TOO GOOD

—THE—

SIMPLEX

—IS THE—

BEST

WITNESS THE FOLLOWING:

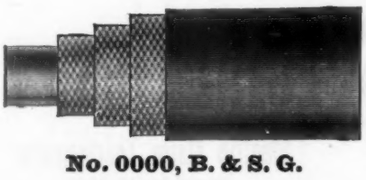
WEST END STREET RAILWAY CO.,
BOSTON, MASS., March 13, 1890.

SIMPLEX ELECTRICAL CO., Boston, Mass.:

Gentlemen: In regard to your inquiry concerning my opinion of the Simplex Wires, I would say that during the last year we have used a great many miles of the larger sizes, principally the **0000,** and it has given excellent satisfaction. There has been no case, to my knowledge, of trouble arising from these wires.

The general appearance and workmanship of the wire are first-class, and I consider it equal to any wire, and superior to most wires, for overhead work. Yours truly,

F. S. PEARSON,
Chief Engineer Steam and Elect. Dept.



No. 0000, B. & S. G.

Send for Estimates to

SIMPLEX ELECTRICAL CO.,

620 ATLANTIC AVE.,

Boston, Mass.

A. C. POND, Prest., A. F. MASON, Gen. Mangr.

EUGENE F. PHILLIPS, PRESIDENT. W. H. SAWYER, SEC. & ELECTRICIAN.

AMERICAN ELECTRICAL WORKS,

Manufacturers of Patent Finished

ELECTRIC LIGHT WIRE,

MAGNET WIRE, OFFICE & ANNUNCIATOR WIRE.
RUBBER COVERED WIRE, LEAD ENCASED WIRE.
TELEPHONE & INCANDESCENT CORDS.

FARADAY CABLES.

Office and Factory, 67 STEWART STREET., PROVIDENCE, R. I.
New York Office, 10 Cortlandt St., P. C. Ackerman, Agt.

Standard Electrical Test Instruments.

AMMETERS AND VOLTMETERS
FOR DIRECT AND ALTERNATING CURRENTS.

QUEEN'S NEW PORTABLE TESTING SETS

ACCURATELY ADJUSTED. PRICES, $75 TO $125.

Ammeters and Voltmeters Repaired and Recalibrated.

Send for Catalogue 1-66 of Electrical Test Instruments.

QUEEN & CO., PHILADELPHIA.

PHŒNIX GLASS CO

OF PITTSBURGH, PA.

MANUFACTURERS OF A FULL LINE OF

ELECTRIC LIGHT

GLOBES SHADES

BOTH ARC AND INCANDESCENT.

RICH CUT, OPAL, CLEAR, ETCHED, ROUGHED, ETC.

ADAPTED TO ALL SYSTEMS.

729 BROADWAY, NEW YORK.
(COR. WAVERLY PLACE), AND
43 SIXTH AVE., PITTSBURGH, PA.

F. Z. MAGUIRE,

ELECTRICAL SECURITIES, ETC.,

18 WALL STREET,

NEW YORK.

ELECTRIC AND STREET RAILWAY PROPERTIES BOUGHT AND SOLD.

THE PATENT FOR THE UNITED STATES

for a glowing lamp which has been introduced to the public for years and is acknowledged to be of very favorable construction, is for sale on the most acceptable terms, or royalties may be sold. Please address offers to

Ho. 9932, care HAASENSTEIN & VOGLER, A. G., Berlin, S. W., 19, Germany.

Norway Iron Frame

ELECTRIC BELL

IS THE

CHEAPEST AND BEST.

Send for Illustrated Circular of Bells and

Other Electrical Goods.

J. ELLIOTT SHAW & CO.,
632 ARCH ST., PHILA.

THE GREATEST

POROUS CUP BATTERY

IN THE WORLD.

SEND FOR CIRCULARS.

THE LECLANCHÉ BATTERY CO.,

NEW YORK.

MOULDINGS

FOR ELECTRICAL WORK, IN ALL KINDS OF WOOD.

Office and Storehouse:
550 and 552 West 38th Street
NEW YORK.

Independent Bung Co.

Large Stock Always on Hand.

Factories:
Elizabeth, Wirt Co., W. Virginia,
and NEW YORK.

GENUINE TELEPHONES FOR EXPORT.

THE TROPICAL AMERICAN TELEPHONE CO.,

Sole Authorized Exporters to South America, Central America and West Indies.

AMERICAN BELL TELEPHONES, BLAKE TRANSMITTERS AND MAGNETOS.

OLD SWITCHBOARDS AND MAGNETO CALL BELLS

For Sale Cheap and Taken in Exchange for New Ones.

A Platinum Pointed "Chicago" Magneto Telephone Set for $17.00. A New Magneto Telephone Set, complete, like cut, for $15.00. Tropical American Telephone Sets and Universal Long Distance Sets. W. E. Co. Standard Switchboards and New Williams Standard Switchboards in all the different styles and sizes.

PATENTED TELEPHONIC APPARATUS AND SUPPLIES OF ALL SORTS AT LOWEST PRICES.
Send for New Catalogue, Price List and Pamphlet, to
NEW YORK OFFICE, 18 CORTLANDT STREET, or BOSTON OFFICE, 95 MILK STREET.

HOLMES, BOOTH & HAYDENS,

MANUFACTURERS OF

BARE AND INSULATED WIRE,

Underwriters' Copper Electric Light Line Wire, handsomely finished, highest conductivity. Copper Magnet Wire, Flexible Silk, Cotton and Worsted Cords for Incandescent Lighting. Round and Flat Copper Bars for Station Work. Insulated Iron Pressure Wire.

TRADE MARK "K.K."

PATENT "K. K." LINE WIRE

TRADE MARK "K.K."

For Electric Light, Electric Railways, Motors, Telegraph and Telephone Use.

Agents for the WASHINGTON CARBON CO.,

FACTORIES: WATERBURY, CONN.

NEW YORK OFFICE, 25 Park Place,

THOS. L. SCOVILL, NEW YORK AGENT

AGENTS FOR

OKONITE
TRADE MARK.

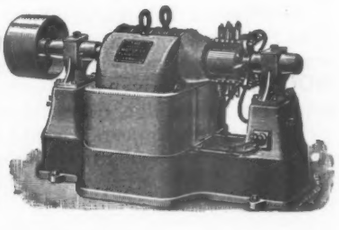
Wires, Tape and Cord,
Candee Wire.

ELECTRICAL SUPPLIES.

Do You Want { The Best Goods / Good Prices / PROMPT SHIPMENTS } ?

IF YOU DO, WRITE US FOR QUOTATIONS.

AGENTS FOR THE CONNECTICUT MOTORS.



SOUTHERN ELECTRICAL SUPPLY COMPANY,

823 LOCUST STREET, ST. LOUIS, MO.

NASSAU ELECTRICAL SPECIALTIES.

E. M. F., 1.07. Current, 2.20 amperes.

CAPSULE BATTERY.

(Patented Aug. 19, 1890.)

SMALLEST EFFECTIVE BATTERY IN EXISTENCE.

PERFECTLY DRY.

Does not Require Wiring.

Never Polarizes.

Power Constant.

Sample by mail, $1.10.

ELECTRICAL BELL OUTFIT.

(Patented Aug. 19, 1890.)

The Simplest and Most Complete Portable Bell Outfit in the market. The bell is operated by the Nassau Capsule Battery, concealed in the case of the push button.

This battery is not connected by wires and can by withdrawn and replaced by the user instantaneously when a renewal is necessary.

Electric Alarm Thermometer.

(Patented Aug. 19, 1890.)

This thermometer sounds an alarm whenever the temperature rises above or falls below any required point.

It is designed for use in Offices, Schools, Hospitals, Living Rooms, Baths, Breweries, Factories and all places where the maintenance of an equable temperature is desirable.

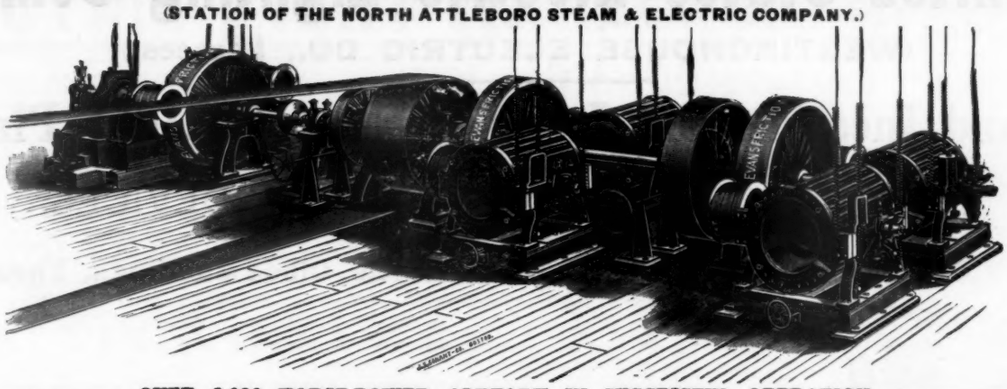
It can be arranged to sound at any distance from the thermometer, and can thus be used as an infallible guard against fire.

NASSAU ELECTRICAL CO., 19 Park Place, New York.

THE EVANS SYSTEM OF DRIVING DYNAMOS.

(STATION OF THE NORTH ATTLEBORO STEAM & ELECTRIC COMPANY.)

Write for full particulars and list of parties using.



This station has been running constantly since March, 1890.

OVER 3,000 HORSE-POWER ALREADY IN SUCCESSFUL OPERATION.

Send for Catalogue D to The Evans Friction Cone Co., 85 Water St., Boston, Mass.

LIST OF DYNAMOS IN STOCK.

Designation of Machine.	No. Lights 2,000 c. p. 10 amp. X	No. Lights 1,600 c. p. 8 amp. Y	No. Lights 1,200 c. p. 6 amp. Z	No. Lights 800 c. p. 4 amp.	Horse-Power at Pulley of Dynamo.	Width of Single Belt in Inches.	Belt Speed Required.	Weight of Dynamo.
C	8	.....	.....	.....	6.5	1¼	5,000 FEET PER MINUTE.	530
C	.....	10	.....	.....	6.3	1¼		530
C	.....	.....	.....	25	8.0	2		530
C	16	.....	.....	.....	12.0	2½		780
C	.....	20	.....	.....	12.5	2½		780
C	.....	.....	26	.....	13.0	2½		780
C	20	.....	.....	.....	15.0	3		990
C	.....	25	.....	.....	15.6	3		990
C	.....	.....	32	.....	15.0	3		990
C	.....	.....	.....	50	16.0	3		990
C	28	.....	.....	.....	21.0	4½		1,360

Ball Electric Light Co.
404
WEST 27th STREET.
NEW YORK

LIST OF DYNAMOS IN STOCK.

Designation of Machine.	No. Lights 2,000 c. p. 10 amp. X	No. Lights 1,600 c. p. 8 amp. Y	No. Lights 1,200 c. p. 6 amp. Z	No. Lights 800 c. p. 4 amp.	Horse-Power at Pulley of Dynamo.	Width of Single Belt in Inches.	Belt Speed Required.	Weight of Dynamo.
G	.....	.....	35	.....	21.0	4	5,000 FEET PER MINUTE.	1,360
G	.....	.....	.....	45	21.0	4		1,360
G	.....	.....	.....	.....	21.0	4½		1,360
H	40	.....	.....	.....	29.7	6		1,750
H	.....	50	.....	.....	30.0	6		1,750
H	.....	.....	64	.....	29.5	6		1,750
I	52	.....	.....	.....	38.0	8		2,290
I	.....	65	.....	.....	38.6	8		2,290
I	.....	.....	83	.....	38.0	8		2,290
J	64	.....	.....	.....	46.5	10		2,770
J	.....	80	.....	.....	47.1	10		2,770
K	75	.....	.....	.....	52.5	12		3,300

DEPARTMENT OF ENGRAVING,
ELECTRICAL REVIEW,
13 PARK ROW NEW YORK.
ELECTRICAL ENGRAVING, A SPECIALTY.
SEND FOR ESTIMATES OF CATALOGUE & ELECTRICAL ENGRAVING, OF EVERY DESCRIPTION.

GENUINE
INGOTS & MANUFACTURES
BEAR OUR
REG. TRADE MARKS
Phosphor Bronze
PHOSPHOR-BRONZE
INGOTS, CASTINGS & MANUFACTURES
THE PHOSPHOR BRONZE SMELTING CO. LIMITED
512 ARCH ST. PHILADELPHIA PA. U.S.A.
ORIGINAL MANUFACTURERS OF PHOSPHOR BRONZE IN THE UNITED STATES AND OWNERS OF THE U.S. PATENTS

THE American Bell Telephone Company,

95 MILK ST., BOSTON, MASS.

This Company owns the Letters Patent granted to Alexander Graham Bell, March 7th, 1876, No. 174,465, and January 30, 1877, No. 186,787.

The Transmission of Speech by all known forms of ELECTRIC SPEAKING TELEPHONES infringes the right secured to this Company by the above patents, and renders each individual user of telephones, not furnished by it or its licensees, responsible for such unlawful use, and all the consequences thereof and liable to suit therefor.

Electric Bells and all About Them.

BY S. R. BOTTONE.

A Practical Book for Practical Men.

WITH MORE THAN 100 ILLUSTRATIONS.

SECOND EDITION. REVISED.

PRICE, - - 50 CTS.

SENT POSTAGE PREPAID TO ANY ADDRESS ON RECEIPT OF PRICE.

Electrical Review,

13 PARK ROW,

P. O. Box 3329. NEW YORK.

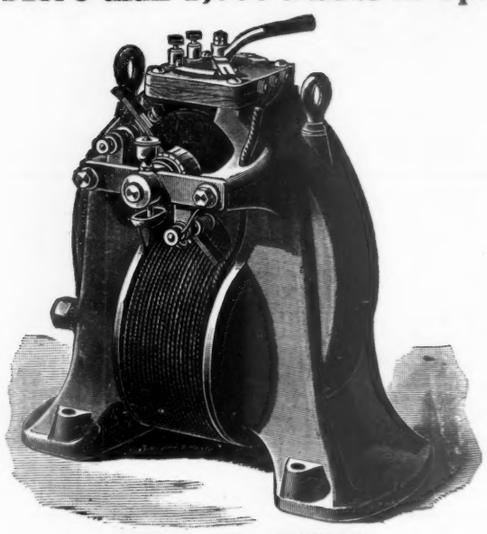
The United States Electric Lighting Company,

(WESTINGHOUSE ELECTRIC CO., Lessees.)

Arc and Incandescent Isolated Electric Light Plants.

AUTOMATIC DYNAMOS. PERFECT DEVICES.

More than 1,000 Plants in Operation in Mills, Hotels, Office Buildings, Theatres, Etc.



NEW U. S. MOTOR.

ELECTRIC MOTORS AND GENERATORS.

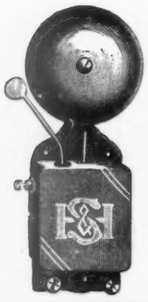
Direct Current Generators and Motors for all purposes. 1-8 horse-power up to any power desired, and of any required E. M. F. Superior in Design and Workmanship, and Unequalled in Efficiency.

SEND FOR NEW U. S. CATALOGUE ON INCANDESCENT LIGHTING AND MOTORS.

General Offices: EQUITABLE BUILDING, 120 Broadway, New York.

MESSRS. STANLEY & HALL,

32 and 34 Frankfort Street, New York.



It gives me much pleasure to say that in my experience with your celebrated S. and H. bell, I have had the most satisfactory results; in one case, out of 136 bells in a building, each of which are used several times daily, there has not been one instance where there has been trouble in the two years they have been in use.

Yours truly,

EMIL GRAH,

Toledo, Ohio.

Shultz Belting Company,

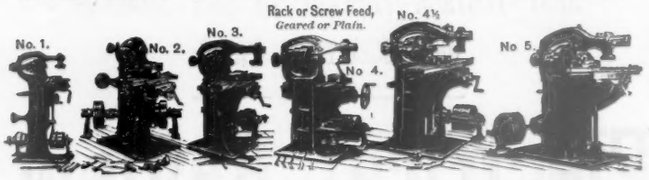
MANUFACTURERS OF

SHULTZ PATENT FULLED LEATHER BELTING AND LACE LEATHER

Office and Factory: Cor. Bismarck and Barton Sts., St. Louis, Mo.

Our Belting is made of leather tanned on the surface only; the interior (which is the fiber and strength of the hide) is not tanned but rawhide fulled and softened by our patent process. Our Belting is more pliable, hugs the pulley better, transmits more power than any other, and is the only perfect ELECTRIC LIGHT BELT MADE. Agents in all cities. Send for trial belt.

OUR LINE OF PLAIN MILLING MACHINES.



THE GARVIN MACHINE COMPANY,

Manufacturers of, and Dealers in, all kinds of

MACHINERY AND MACHINE TOOLS.

Universal and Plain Milling Machines, Drill Presses, Screw Machines, Hand and Engine Lathes, Planers, Profilers, Chucking Machines,

Gear Cutters, Die and Cutter Grinders, Tapping Machines, Wire-Spring Coilers, Milling Cutters, &c.

Plants for Manufacturers of Sewing Machines & Electrical Goods.

GEAR-CUTTING AND MILLING IN ALL ITS BRANCHES.

Laight & Canal Sts. [Catalogue sent on Application.] **NEW YORK.**

HYDRAULIC PRESSES.

ALL VARIETIES.

PUMPS, VALVES, GAUGES AND FITTINGS, PUNCHES, SHEARS, BUFFING MACHINERY, &c.

WATSON & STILLMAN,

210 East 43d Street, New York City.

Special Attention to Electrical Work.

THE LEHIGH VALLEY CREOSOTING CO.

WORKS, PERTH AMBOY, N. J.

Office, Foot of Washington Street, JERSEY CITY, N. J.

Creosoted Lumber, Underground Conduits, Telegraph Poles, Piling and Ties Furnished.

ELECTRIC CONDENSERS

WM. MARSHALL, MANUFACTURER.

Standards a Specialty.

Rooms 2 and 4, University Building, New York.

Everybody's Hand-Book —OF— ELECTRICITY,

By EDWARD TREVERT,

With Glossary of Electrical Terms, and Tables for Incandescent Wiring.

120 PAGES, 50 ILLUSTRATIONS.

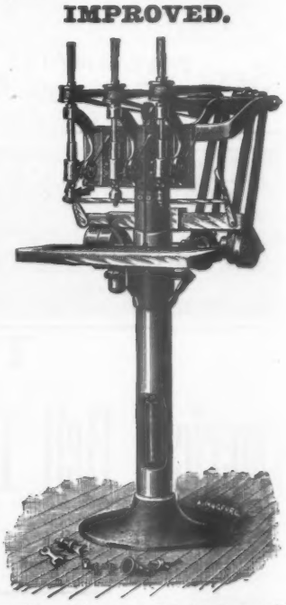
Price, Paper, 25 cents, Cloth, $1.00, post paid.

Bubier Publishing Co.,

LYNN, MASS.

Sigourney Drills.

IMPROVED.



Sensitive, Strong and Interchangeable. One, Two and Three Spindles.

GUARANTEED PERFECT.

Send for Price List "B."

The Sigourney Tool Co.,

HARTFORD CONN.

SUBSCRIBE FOR THE ELECTRICAL REVIEW. NOW

FARADAY CARBON CO.,
ELECTRIC LIGHT CARBONS, PITTSBURGH. PA

ELECTRICAL MEASUREMENT

Instruments and Batteries of the Very Highest Grade.

Precision and Constancy, Quality and Finish the Best in the World.

Catalogue of Standard Test Instruments furnished upon application.

THE E. S. GREELEY & CO.,

5 AND 7 DEY ST., NEW YORK.

W. R. OSTRANDER & CO.

195 & 197 FULTON ST., NEW YORK.

Manufacturers of

SPEAKING TUBES, WHISTLES, ANNUNCIATORS, Electric and Mechanical Bells.

FACTORY,

De Kalb Ave., BROOKLYN.

Send for Illustrated Catalogue.

Something New! One, two, three, and four spindle drills for light work.

DRILLS

The most useful patented improvement in drill presses for years is applied.

SENSITIVE

Spindles driven with single, endless belts. Large driving pulleys, tightener and variable speeds provided.

Over 1,000 in use. Buy the **latest** and **best.** Special machinery to order. Catalogue of fine tools free.

Dwight Slate Machine Co.

HARTFORD, CONN.

ROYCE & MAREAN,

DEALERS IN

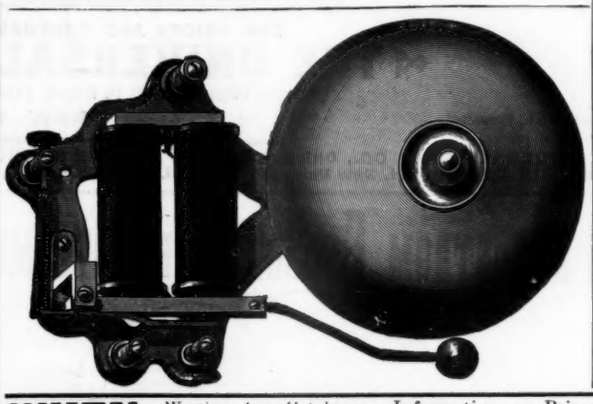
ELECTRICAL APPARATUS,

Telegraph and Telephone Supplies,

No. 1408 Penna. Avenue,

Opp. Willard's Hotel. WASHINGTON, D. C.

Manufacturers



H. E. & C. BAXTER,

18 Fulton Street, Brooklyn, N. Y.

WHEN Writing for Catalogues, Information or Prices, **YOU WILL CONFER A FAVOR** on both the **ADVERTISER** and the **PUBLISHER** by mentioning the fact that you saw the advertisement in the *ELECTRICAL REVIEW.*

SUPPLIES FOR ALL SYSTEMS.

Prompt Shipments. Write for Prices.

W. H. GORDON & CO.,

ELECTRIC LIGHT AND POWER SUPPLIES,

SIMPLEX WIRES. *115 Broadway, New York.*

THE

PARKER-RUSSELL MINING & MFG. CO.

MERMOD-JACCARD BUILDING,

Cor. Broadway and Locust St. Rooms 307 and 308.

ST. LOUIS.

SUNLIGHT CARBONS

UNIFORM IN QUALITY, LONG LIFE AND GOOD LIGHT

The Burton Electric Heater for Electric Railway Cars

NO SMOKE! NO GASES! EASILY MANAGED! ECONOMY IN SPACE!

Normal use of current, THREE AMPERES, and the cost of this is in the coal burned at the generating station, which is actually LESS than that of coal burned in a stove on a car.

"They are giving us and the public entire satisfaction."—RICHMOND, VA., U. P. RY. CO.
"The heat is pleasant, sufficient and economical."—MARLBOROUGH, MASS., STREET RY. CO.
"We are much pleased with them, and know of no reason why we shall not continue to use them and recommend them to others."—ST. LOUIS AND EAST ST. LOUIS ELECTRIC RY. CO.

AGENCIES:
Equitable Electric Ry. Construction Co., 416-420 Commercial Union Building, Phila., Pa.
Higgins Brothers & Co., 202 Main Street, Buffalo, N. Y.
Electric Merchandise Co., 11 Adams Street, Chicago, Ill.
St. Louis Car Co., St. Louis, Mo.

For Further Information, Address,

THE BURTON ELECTRIC COMPANY, RICHMOND VA

Washburn & Moen Mfg. Co.,

WORCESTER, MASS.

MAKERS OF

IRON AND STEEL

MANUFACTURERS OF

Iron and Copper Wire for Electrical Purposes.

PATENT GALVANIZED TELEGRAPH & TELEPHONE WIRE,

In Long Lengths, Galvanized by our Patent Continuous Process.

The Standard with all Telegraph and Telephone Companies.

Since the first introduction of the Electric Telegraph Service, our patent wire, expressly manufactured for electric purposes, has filled every requisition as regards strength, evenness of quality, and conductive capacity.

Send for Price Lists and descriptive pamphlets, and "Hand-book of Wire in Electric Service." Sent free on application.

New York Warehouse, 16 CLIFF STREET.

Chicago Warehouse, 107 & 109 LAKE ST.

NEW YORK BELTING AND PACKING CO.

LARGEST BELTS IN THE WORLD.

RUBBER BELTING, PACKING, HOSE,— —MATS, MATTING, STAIR-TREADS.

15 PARK ROW, NEW YORK.

(OPPOSITE ASTOR HOUSE.)

J. H. CHEEVER, TREAS. J. D. CHEEVER DEP'Y. TREAS.

GIVES MORE POWER USING LESS WATER THAN ANY OTHER WHEEL.

THE OLD RELIABLE —LEFFEL— WATER WHEEL

SEND FOR CATALOGUE.

JAMES LEFFEL & CO.

SPRINGFIELD, O., OR 110 LIBERTY ST., N. Y.

"Prices are low yet quality tells."

A Corliss Engine

well designed and thoroughly built, is the best the world today possesses.

The Lane & Bodley Co., Cincinnati, O., have a high ideal of what their engines should be, and invite their customers to say what they are. If you want an engine and never have seen one of these, write for descriptive circular.

THE LANE & BODLEY CO., CINCINNATI, O.

W. E. WEATHER-PROOF WIRE.

We quote from a letter received from a well-known expert regarding recent tests of the leading weather-proof wires now on the market:

We have tested the samples of wire handed us, and make the following report, the size of the wire, length of pieces and the immersion, being exactly the same in all particulars:

RESISTANCE OF INSULATION.

SAMPLE.	ON IMMERSION.	AFTER 24 HOURS.	48 HOURS.	96 HOURS.	144 HOURS.
No. 1,	28,000 megohms,	130,000 ohms,	80,000 ohms,	27,586 ohms,	25,000 ohms.
" 2,	93 "	960,000 "	320,000 "	10,000 "	1,363 "
" 3,	7 "	900,000 "	800,000 "	500,000 "	272,727 "
" 4,	.46 "	65,000 "	2,856 "	1,600 "	1,000 "
" 5,	3.5 "	83,000 "	0 "	0 "	0 "
" 6,	2.8 "	7,000 "	4,000 "	1,666 "	1,071 "

Sample No. 8 is our improved weather-proof wire, and we guarantee it the equal, if not the superior, of any other wire of like character. PRICES ON APPLICATION.

WESTERN ELECTRIC COMPANY, CHICAGO---NEW YORK.

ARC LAMPS FOR INCANDESCENT CIRCUITS.

THE UNIVERSAL ARC LAMPS. These lamps are intended for direct current circuits, giving a steady and noiseless light, and can be adjusted for circuits having a pressure from 100 to 125 volts, using from eight to nine amperes; when burning two in series, the resistance is coiled about the chimney at the top of each lamp, within which the carbon rod is suspended, thereby rendering any additional resistance unnecessary.

Electric light stations and owners of isolated plants using low potential currents will do well to examine this lamp before purchasing elsewhere, as our claim for the lamp is that it is the best article in the market.

THE UNIVERSAL THEATRICAL ARC LAMP. This lamp is manufactured for stage uses, taking the place of the calcium lights, and can be used wherever constant direct circuits exist; it can be easily handled and has all the effects of the calcium, and the cost of running same being very much cheaper than the old-fashioned method. We are prepared to furnish complete outfits at shortest notice; prices and references on application.

FOR PRICES AND FURTHER INFORMATION, APPLY TO

THE UNIVERSAL ARC LAMP CO.,

Executive Office: 16 AND 18 BROAD STREET. Salesrooms: 49 WEST 22d STREET.

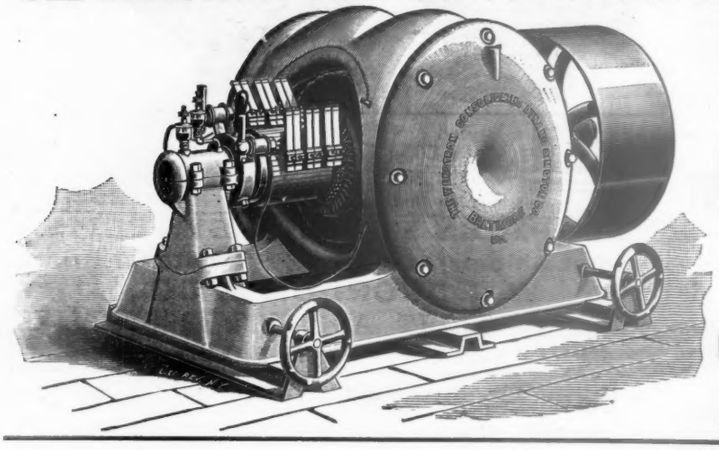
J. H. McCLEMENT, President. NEW YORK. E. S. MENDELS, General Manager.

OR TO

THE ELECTRICAL SUPPLY CO., Chicago, Ill. ST. LOUIS ELECTRICAL SUPPLY CO., St. Louis, Mo. SOUTHERN ELECTRICAL MFG. & SUPPLY CO., Limited, New Orleans, La. WALKER & KEPLER, Philadelphia, Pa. PETTINGELL-ANDREWS CO., Boston, Mass.

THE WENSTROM CONSOLIDATED DYNAMO AND MOTOR CO., OF BALTIMORE, MD.,

MANUFACTURERS OF



ELECTRICAL APPARATUS,

ELECTRIC MOTORS FOR ALL WORK,

Dynamos for Incandescent Lighting.

SPECIAL FEATURES:

High Efficiency. ✳ Slow Speed.

For full information and circulars address,

CHADBOURNE, HAZELTON & CO.,

SOLE SELLING AGENTS FOR U. S.,

416-420 WALNUT ST., PHILADELPHIA.

AGENTS WANTED IN ALL LEADING CITIES.

BUY THE

SCHUYLER APPARATUS

IF YOU WANT THE BEST

Arc Lighting System.

Office and Factory:

MIDDLETOWN,

CONN.

INTERNATIONAL ALUMINUM WORKS,

Manufacturers, under Prof. H. G. Coyle's Processes, of

Aluminum Electroplating Solutions and Anodes.

(PATENTS APPLIED FOR.)

COMPLETE OUTFITS FOR ALUMINUM ELECTROPLATING A SPECIALTY.

County and State Rights Sold. No Royalty.

Offices, 36 & 38 JOHN STREET, NEW YORK, U. S. A.,

And 86 New Street, Birmingham, England.

LABORATORY AND SHOW ROOMS, 53 MAIDEN LANE, NEW YORK.

You make a mistake if you don't buy ELECTRICAL SUPPLIES from F. and F., Cleveland, Ohio. SEND FOR THE LATEST "LIST of BARGAINS FOR BELL HANGERS" AND "ROCK BOTTOM" ON MEDICAL BATTERIES. WE UNDERSELL ALL. ADDRESS, Fletcher & Fletcher Electric Co., Cleveland, Ohio. Mention this paper if you want bottom prices.

WELLINGTON

Belt Holder

The simplest, cheapest and handiest device in existence for shifting Dynamo Belts. Please write for circulars to

W. R. STANTLEY & CO.

WELLINGTON, O.

Daniel W. Baker. Cyrus O. Baker, Jr.

BAKER & CO.,

Importers, Melters and Refiners of

PLATINUM,

408, 410, 412 and 414 N. J. R.R. Ave., NEWARK, N. J.

Platinum in sheet and wire, all sizes, and any degree of hardness. Scrap and native platinum purchased

Industries.

A Journal of Engineering, Electricity and Chemistry

FOR THE

MECHANICAL AND MANUFACTURING TRADES.

PUBLISHED EVERY FRIDAY.

ANNUAL SUBSCRIPTIONS.	Thick Paper.	Thin Paper.
GREAT BRITAIN, Post Free	$6 00	$6 00
THE UNITED STATES, CANADA and COUNTRIES INCLUDED IN THE POSTAL UNION, Post Free	9 00	8 00
INDIA, CEYLON, STRAITS SETTLEMENTS, CHINA, JAPAN, &c., Post Free	10 75	9 00

SUBSCRIPTIONS PAYABLE IN ADVANCE TO

GEO. CAWLEY, 358 STRAND, LONDON, W. C.

Manchester, 70 Market St.; Glasgow, 93 Hope St.; Yokohama (Japan), 32 Main St.

American Subscriptions to "Industries" are received by the Publisher of the ELECTRICAL REVIEW, 13 Park Row, New York.

AMERICAN AND FOREIGN BOOKS ON ELECTRICITY AND ITS APPLICATIONS.

Electricity, Magnetism, Etc., Etc.

Adams. Essay on Electricity $4 00
Angell. Elements of Magnetism and Electricity. Cloth, 238 pages, 151 illustrations 75
Anderson. Lightning Conductors. Cloth 6 50
Atkinson. Elements of Static Electricity 1 50
Ayrton. Practical Electricity. For students of electrical engineering. 516 pages, 180 illustrations 2 50
Barlow. Magnetic Attractions 4 00
Barnard. First Steps in Electricity 75
Benjamin. Age of Electricity 2 00
Brennan. A Popular Exposition of Electricity. 191 pages 75
Blakesley. Alternating Currents of Electricity. Cloth 1 50
Bottone. The Dynamo. How Made and How Used. A book for amateurs. Cloth. 1 00
Cavendish. Electrical Researches. Cloth 5 00
Cook. Magnetism and Electricity. Cloth, 48 illustrations 40
Cumming. Electricity Treated Experimentally. Cloth, 100 diagrams 1 50
Davis. Manual of Magnetism, Galvanism, etc 3 00
Deschanel. Electricity and Magnetism. Cloth 1 50
De Fonvielle. Thunder and Lightning. Cloth, 285 pages 1 00
De La Rue. Experimental Researches in the Electric Discharge with the Chloride of Silver Battery 3 60
Du Moncel. Electro-Magnets. Boards, 50c.; English Edition 75
Dunman. Short Text Book of Electricity and Magnetism 40
Dyer. Induction Coils; How Made and How Used. Boards 50
Electricity in the Service of Man 6 00
Everett. Units and Physical Constants 1 10
Faraday. Experimental Researches in Electricity. 3 vols., cloth 20 00
Fiske. Electricity in Theory and Practice. Cloth, 270 pages, 180 illustrations 2 50
Ferguson. Electricity. Cloth 1 50
Fleming's. Short Lectures to Electrical Artisans 1 50
Francis. Electrical Experiments 2 50
Gordon. School Electricity. Cloth, 262 pages, 139 illustrations 2 00
Gordon. A Physical Treatise on Electricity and Magnetism. 2 vols., cloth 10 00
Gladstone & Tribe. The Chemistry of the Secondary Batteries of Plante and Faure. 1 00
Gordon. Four Lectures on Static Electric Induction. Cloth 80
Guthrie. Magnetism and Electricity 1 25
Hamilton. The Origin of Energy, Electrostatics and Magnetism 2 00
Heap. Electrical Appliances of the Present Day. Cloth 2 00
Hospitalier. Domestic Electricity. Cloth, 229 pages, 155 illustrations 3 00
Hospitalier. The Modern Applications of Electricity. Cloth 8 00
Harris. Rudimentary Electricity. Flexible, 69 illustrations 60
Harris. Rudimentary Magnetism. Cloth, 165 illustrations 1 40
Harris. Galvanism, Animal and Voltaic Electricity 60
Hering. Winding Magnets for Dynamos. 63 pages 1 25
Jeans. Lives of the Electricians 2 25
Jenkin. Electricity and Magnetism. Cloth, 177 illustrations 1 50
Kirwan. Modern Electricity with Glossary of Electrical Terms. 128 pages 80
Kohlrausch. Physical Measurements, with Appendices on Absolute Electrical Measurements 6 00
Lardner. Hand-Book of Electricity, Magnetism and Acoustics. 400 illustrations, cloth 2 00
Levander. Solutions of Questions in Magnetism and Electricity. Cloth 1 00
Lightning Flashes and Electric Dashes 1 00
Lloyd. Treatise on Magnetism 5 00
Lock. Workshop Receipts. Devoted mainly to Electrical and Metallurgical subjects. Cloth 2 00
Mahon. Principles of Electricity 5 00
Martin & Wetzler. Electric Motor and its Applications. 208 pages, 199 illustrations. 3 00
Mascart & Joubert. A Treatise on Electricity and Magnetism. Vol. 1, cloth, 654 pages, 127 illustrations 7 50
Maxwell. A Treatise on Electricity and Magnetism. 2 vols., 20 plates and 105 illustrations 8 00
Maxwell. An Elementary Treatise on Electricity. 6 plates, 54 illustrations 2 00
May. Bibliography of Electricity 2 00
McClure. Edison and his Inventions 1 00
Mendenhall. A Century of Electricity 1 25
Merwin. Patentability of Inventions 6 00
Miller. Magnetism and Electricity. 212 pages, illustrated 2 50
Munro. Electricity and its Uses. Cloth 1 40
Murdock. Notes on Electricity and Magnetism. Cloth, 38 illustrations 60
Munro & Jamieson. Electrician's Pocket-Book of Electrical Rules and Tables 2 50
Niaudet. Elementary Treatise on Electric Batteries. Cloth, 55 illustrations 2 50
Nipher. Theory of Magnetic Measurements 1 00
Noad. The Student's Text-Book of Electricity. Cloth, illustrated 4 00
Overend. Elementary Experiments in Magnetism and Electricity. Cloth 40
Parkinson. Ocean Telegraph to India 4 00
Parnell. Action of Lightning and Means of Defending Life and Property from its Effects 3 00
Plante. Storage of Electrical Energy. 268 pages, 89 illustrations 4 00
Pynchon. Introduction to Chemical Physics. 550 pages, 269 illustrations 3 00
Radau. Wonders of Acoustics; or, The Phenomena of Sound. Cloth, 288 pages, 116 illustrations 1 00
Rankine. Rules and Tables for Engineers 4 00
Reports of the Committee on Electrical Standards. Cloth 3 75
Rogers. Magnetism of Iron Vessels 50
Salomons. The Management of Accumulators 1 20
Spang. Treatise on Lightning Protection. Cloth, illustrated 75
Stewart & Gee. Electricity and Magnetism. 497 pages, 223 illustrations 2 25
Swinburne. Practical Electrical Units Popularly Explained. Cloth 60
Tarn. Magnetism and Electricity. A book for students 80
Techno-Chemical Receipt Book 2 00
Thompson. Elementary Lessons in Electricity and Magnetism. Cloth, 168 illustrations 1 25
Thompson. Recent Progress in Dynamo Electric Machinery 50
Thomson. Electro-Statics and Magnetism 5 00
Treglohan. Frictional Electricity 50
Tyndall. Lessons in Electricity at the Royal Institute, 1875-6. Cloth 1 00
Watson and Burbury. The Mathematical Theory of Electricity and Magnetism. Cloth, 268 pages 2 75
Wonders of Acoustics; or, The Phenomena of Sound. Cloth, 288 pages 1 00
Woodbury's Protection and Construction of Mill Floors. Cloth 2 50
Welch. Table of Relative Weights of Copper Conductors 10
Woodward. Arithmetical Physics. Boards 80

Telegraphy and Telephony.

Abernethy. Commercial and Railway Telegraphy. Illustrated, cloth 3 00
Beechey. Electro-Telegraphy. Cloth. 36 illustrations 40
Clarke & Sabine. Electrical Tables and Formulæ. Cloth 5 00
Culley. Hand-Book of Practical Telegraphy. Cloth, 442 pages 6 00
Davis & Rae. Hand-Book of Electrical Diagrams and Connections 2 00
Douglas. A Manual of Telegraph Construction. 83 diagrams, cloth 6 00
Fahie. History of Telegraphy to 1837. Cloth, 529 pages 3 00
Field. History of Atlantic Telegraph 1 25
Globe Telegraph Code 2 00
Hoskiaer. Laying and Repairing Electric Telegraph Cables. Cloth 1 50
Hoskiaer. A Guide for the Electric Testing of Telegraph Cables. Cloth 1 50
Jones. Historical Sketch of the Electric Telegraph 2 00
Lardners. Electric Telegraph Popularized 1 50
Lockwood. Electricity, Magnetism and Electric Telegraphy. Cloth, 376 pages 2 50
Loring. A Hand-Book of the Electro-Magnetic Telegraph. Boards, 50c.; cloth, 75c.; morocco 1 00
Maver & Davis. The Quadruplex. Cloth, 126 pages 1 50
Mullaly. Laying of the Cable 4 00
Pope. The Modern Practice of the Electric Telegraph. Cloth, 70 illustrations 1 50
Plum. The Military Telegraph During Our Civil War. Two vols., portraits and illustrations 5 00
Preece & Silveright. Telegraphy. Cloth 1 50
Prescott. Electricity and the Electric Telegraph. Cloth, 670 illustrations, 2 vols 5 00
Sabine. History and Progress of the Electric Telegraph. Cloth, 134 illustrations 1 25
Sauer. Telegraph in Europe 4 00
Schwendler. Instructions for Testing Telegraph Lines. 2 vols., cloth, illustrated. 8 00
Smith. Manual of Telegraphy. 31 illustrations, paper 30
Telegraphic Tests 5 60
Terry & Finn. Illustrations and Descriptions of Telegraphic Apparatus. Cloth, 92 pages, 30 plates 1 50
Williams. Manual of Telegraphy. Cloth, 327 pages, 90 illustrations 4 00
Dolbear. The Telephone. Cloth, illustrated 50
Du Moncel. The Telephone, the Microphone and the Phonograph. 70 illustrations, cloth 1 25
Lockwood. Practical Information for Telephonists. Cloth 1 00
Prescott. Bell's Electric Speaking Telephone. 526 pages, 330 illustrations 4 00
Thompson. Philip Reis, Inventor of the Telephone. Cloth, 3 plates and 48 engravings 3 00

Electric Lighting and Transmission of Power.

Alglave & Boulard. The Electric Light. Its History, Production and Application. 458 pages 5 00
Atkinson. Elementary Principles of Electric Lighting 1 50
Badt. Dynamo Tenders' Hand-Book. General Rules for the Care and Operation of Electric Light Plants. 70 illustrations, 93 pages 1 00
Badt. Incandescent Wiring Hand-Book 1 00
Cunynghame. A Treatise on the Law of Electric Lighting. Cloth 5 00
Day. Electric Light Arithmetic. Cloth 40
De Cew, Glacer. Magneto and Dynamo Electric Machines 3 00
Du Moncel. Electric Lignting. 66 illustrations, cloth 1 25
Dredge. Electric Illumination. 2 vols., cloth. Vol. 1 (scarce), $15. Vol. 2 ..... 7 50
Electric Lighting Act, 1882, also the Rules of Board of Trade, October, 1882 ..... 2 00
Foote. Economic Value of Electric Light and Power. 191 pages 1 00
Gordon. A Practical Treatise on Electric Lighting. Cloth 4 50
Grierson. Electric Lighting by Water Power 40
Hedge. Precautions to be Adopted on Introducing the Electric Light 1 00
Hedges. Central Station Lighting. Paper 20
Holmes. Practical Electric Lighting. Cloth 1 00
Higgs. Magneto and Dynamo Electric Machines. 301 pages 2 00
Kapp. Alternate Current Machinery 50
Maier. Arc and Glow Lamps 3 00
Pope. Evolution of the Electric Incandescent Lamp 1 00
Prescott. Dynamo-Electricity. Cloth 5 00
Stephen. Wrinkles in Electric Lighting. Cloth, 45 pages, 23 illustrations 1 00
Schellen. Magneto-Electric and Dynamo Electric Machines. Cloth 5 00
Schilling. Present Condition of Electric Lighting 50
Thompson. Dynamo-Electric Machines. Illustrated, boards 50
Thompson. Dynamo-Electric Machinery. 57 illustrations, boards 50
Thompson. Dynamo-Electric Machinery. Cloth, 527 pages, 324 illustrations 5 00
Thompson. Recent Progress in Dynamo-Electric Machinery 50
Thurston. Stationary Steam Engines, especially as adapted to Electric Lighting Purposes 2 00
Urquhart. Electric Light: its Production and Use. Cloth, 94 illustrations 3 00
Du Moncel. Electricity as a Motive Power. Cloth 3 00
Kapp. Electric Transmission of Energy and its Transformation 3 00
Urquhart. Electro-Motors. Illustrated 3 00
Walker. Practical Dynamo Building for Amateurs 80
Whipple. The Electric Railway 1 00

Testing and Measurements.

Haskins. The Galvanometer and its Uses. Morocco, 8 illustrations 1 50
Kempe. A Hand-Book of Electric Testing. Cloth, 494 pages 5 00
Lockwood. Electrical Measurements and the Galvanometer. Cloth 1 50
Smith's. Dynamometric Measurements 40
Swinburne. Practical Electrical Measurement. 55 illustrations, 155 pages 1 75

Electro-Metallurgy, Electrotyping, Etc., Etc.

Badt. Bell Hanger's Hand-Book. Practical Information and Suggestions to persons having Charge of Batteries, Bells, Annunciators and Electric Gas Lighting Apparatus. 105 pages, 97 illustrations 1 00
Bottone. Electric Bells and All About Them. Practical Instruction for Electric Bell Fitters. Over 100 illustrations, 190 pages 1 20
Bottone. Electrical Instrument Making for Amateurs 2 00
Fontaine. Electrolysis. Cloth, 264 pages 3 50
Gore. The Art of Electro-Metallurgy. Cloth, illustrated 2 25
Napier A Manual of Electro-Metallurgy. Cloth 3 00
Urquhart. Electrotyping. A Practical Manual 2 00
Urquhart. Electroplating. Cloth 2 00
Wahl. Galvanoplastic Manipulations. Cloth 7 50
Watt. Electro-Metallurgy Practically Treated. Cloth 1 00
Watt. Electro-Deposition. Cloth, 568 pages, 144 illustrations 3 50
Wilson. Stereotyping and Electrotyping. Cloth, 195 pages 2 00

☞ Copies of any of the above books will be promptly mailed, POSTAGE PREPAID, to any address in the world on receipt of price. Remit by Express or Post Office Money Order, Postal Note, Draft or Registered Letter. Address

ELECTRICAL REVIEW PUB. CO.,

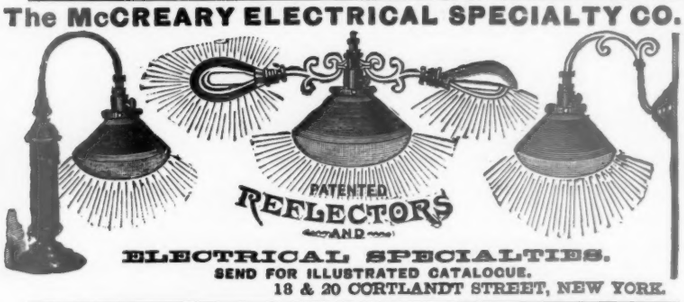
P. O. BOX, 3329. **13 PARK ROW, NEW YORK.**

IRON CASTINGS FOR ELECTRICAL PURPOSES.

We cast Dynamo Magnets of a special mixture of iron that gives much better electrical results than ordinary castings. Also, small castings for Electrical Work, and castings, large and small, for all purposes, of finest quality. OUR PRICES ARE LOW. We run four large cupolas constantly, melting about 35 tons daily. Correspondence solicited.

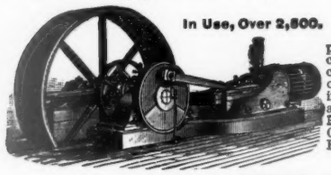
SESSIONS FOUNDRY CO., Bristol, Conn.

The McCREARY ELECTRICAL SPECIALTY CO.



SEND FOR ILLUSTRATED CATALOGUE.
18 & 20 CORTLANDT STREET, NEW YORK.

New Tangye Buckeye Automatic Cut-off Engines.



25 to 1,000 H. P.

These engines are the combined result of long experience with automatic cut-off regulation, and most careful revision of all details. They are designed and constructed for heavy and continuous duty at medium or high rotative speeds. Highest attainable Economy in Steam Consumption and Superior regulation guaranteed. Self-contained Automatic Cut-off Engines 12 to 200 H. P. for driving Dynamo Machines a Specialty. Illustrated Circulars, with various data as to practical Steam Engine Construction and performance, free by mail

Address BUCKEYE ENGINE CO., Salem, Ohio.

SALES AGENTS:
W. L. SIMPSON, 10 Telephone Building, 18 Cortlandt Street, N. Y.
W. M. ROBINSON, 154 Washington St., Chicago, Ill. Robinson & Cary Company, St. Paul, Minn

Porcelain Electrical Supplies and Specialties,

MANUFACTURED BY

EMPIRE CHINA WORKS,

144 & 156 Greene St., GREENPOINT, BROOKLYN, E. D., N. Y.

Our Ware is HARD PORCELAIN, the BODY and GLAZE IDENTICAL, and GUARANTEED NON-CONDUCTIVE for all ELECTRICAL PURPOSES.

THE CROCKER-WHEELER

PERFECTED

MOTORS.

VERY SLOW SPEED—FULL POWER—PERFECT REGULATION—FORGED FIELDS, LET INTO BASE—SELF-OILING BEARINGS—SELF-CENTERING BEARINGS—ALL SIZES—BOTH ARC AND INCANDESCENT—FOR ALL POWER PURPOSES.

Acknowledged by the leading Manufacturing Companies to be

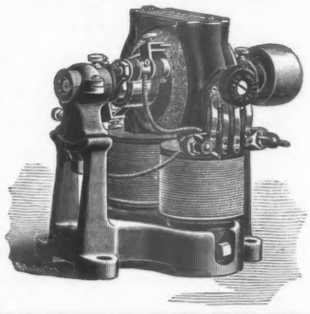
THE MOST PERFECT MOTOR MADE.

Estimates and Plans Furnished for Electric Power Equipment.

CORRESPONDENCE INVITED.

430-432 WEST 14TH STREET, NEW YORK.

S. S. WHEELER, President. F. R. CROCKER, Vice-Pres't.



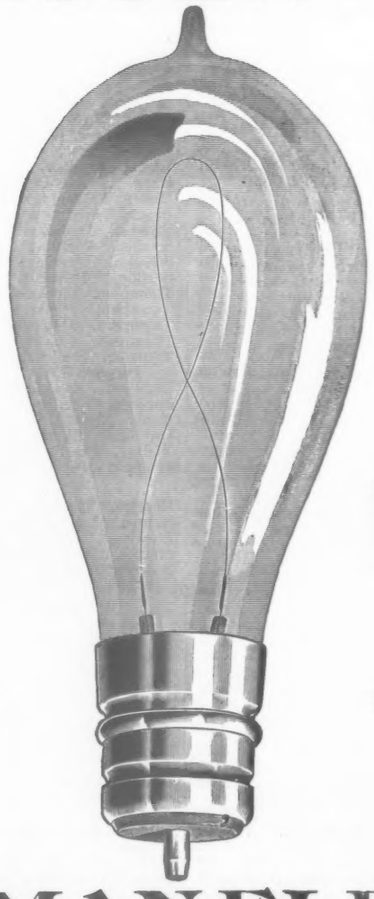
INCANDESCENT LAMPS

To Fit any Socket.

Excelling all others in Life, Maintenance of Candle-Power and Efficiency.

THE BEST IS

General Electrical Supplies of Superior Design and Finish.



Even Diffusion of Light by Twisted Filament.

From 8 Candle-Power to 150 Candle-Power and any Voltage.

THE CHEAPEST

Send for Our Catalogue of August 1st, 1890.

SAWYER-MAN ELECTRIC CO.

620 Atlantic Avenue, BOSTON, MASS.

510-534 WEST 23d STREET, NEW YORK.

217 La Salle Street, CHICAGO, ILL.

THE Electric Telephone.

A second REVISED and ENLARGED edition of

The Electric Telephone

BY

PROF. GEORGE B. PRESCOTT,

has just been published, containing 516 illustrations and 795 pages of reading matter. The new edition contains over 200 illustrated descriptions of new telephone inventions and devices, and includes full descriptions of

Hughes' Induction Balance and Sonometer, Boudet's Medical Michrophone, Edison's Phonograph, Tainter's Graphophone, the Metropolitan Telephone Central Station, Simultaneous Telephone Transmission on the Same Wire, Installation of Telephone Offices, Construction of Telephone Lines, Aerial and Underground; The Electric Subways in New York, Long-Distance Telephone Lines, and Statistics of the American Bell Telephone Companies.

Price, = $6.00

SENT TO ANY ADDRESS ON RECEIPT OF PRICE.

ADDRESS:

Electrical Review,

No. 13 PARK ROW,

P. O. Box 3329. **NEW YORK.**

JUST ISSUED FROM THE PRESS!

WHIPPLE'S Electric, Gas and Street Railway FINANCIAL REFERENCE DIRECTORY

For 1890.

CONTENTS:

List of all Central Electric Light and Power Stations, with Capital Stock, Officers, Systems used, Capacity and Number of Lights in use, Steam Plants, Day Circuits, Kind of Wire and Belts used and Financial Standing.

List of all Isolated Electric Light Plants, with Number and Kind of Lights.

List of all Gas Companies, with Capital Stock, Officers, Price of Gas and Financial Standing, including all Gas Companies operating Electric Light Plants.

List of all Street Railway Companies, with Capital Stock, Officers, Miles of Track, Gauge, Kind of Rail, Number of Cars and Horses, Motive Power, if Electric, Cable or Steam, and Financial Standing.

List of all Telephone Exchanges and Licensed Companies, with Officers and Financial Standing.

Financial Standing of all Manufacturers, Dealers and Agents in the General Electrical World.

Price of all Public Lighting Contracts, with Number and Kind of Lights, Hours Burned, etc.

Rules and Requirements of all the Boards of Fire Underwriters, Insurance Companies, etc.

HANDSOMELY PRINTED AND BOUND.

Sent express paid on receipt of $5; with Monthly Corrections, $6; with Confidential Rate Sheet, $10.

THE FRED H. WHIPPLE CO.,

NEW YORK OFFICE, TEMPLE COURT DETROIT, MICH.

FIELD ENGINEERING COMPANY,

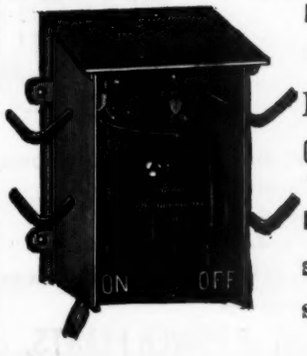
CONSULTING AND CONTRACTING ENGINEERS.

COMPLETE EQUIPMENT OF ELECTRIC STREET RAILWAYS, DESIGNING AND CONSTRUCTION OF STATIONS, STEAM AND POWER PLANTS.

CORRESPONDENCE SOLICITED.

15 Cortlandt St., New York.

THE E. S. GREELEY & CO.,



Nos. 5 & 7 Dey St., New York

Manufacturers and Importers of and Dealers in

Telegraph, Telephone — AND — Electric Light Supplies

AGENTS FOR

Cleveland Arc Light Cut Outs & Gang Switches

Cleats, Rosettes, Moulding, Pins, Cross-Arms, Brackets. Insulating Tapes.

Rubber, Porcelain and Glass Insulators

WIRES OF ALL KINDS.

Silk & Cotton Covered Flexible Conducting Cord of various sizes for Incandescent Lighting.

Spikes, Pole Steps, Lag Screws, Drive Screws, Turn Buckles, Etc.

EUREKA TEMPERED COPPER COMPANY,

NORTH EAST, PA.,

ONLY MANUFACTURERS OF PURE COPPER TEMPERED FOR

Brush Copper, Commutator Bars, Copper Wire, Gear Pinions, Bearings, Trolley Wheels.

WESTERN SALES OFFICE: 225 DEARBORN STREET, CHICAGO.

EASTERN SALES OFFICE: 35 BROADWAY, NEW YORK.

FORT WAYNE ELECTRIC COMPANY,

FORT WAYNE, IND.

MANUFACTURERS OF THE

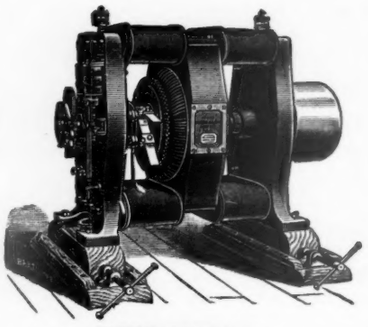
Slattery Induction System of Long Distance Incandescent Lighting

AND THE

Wood Automatically Regulating

ARC DYNAMO AND LAMPS.

Main Office, FORT WAYNE, IND.



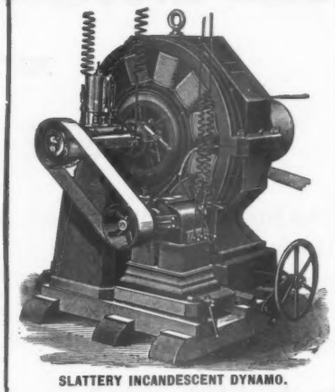
WOOD DYNAMO.

BRANCH OFFICES:

NEW YORK, -	115 Broadway.
PHILADELPHIA,	907 Filbert Street.
PITTSBURGH, PA.,	533 Wood Street.
CHICAGO, - -	185 Dearborn Street.
SAN FRANCISCO,	35 New Montgomery Street.
DETROIT, MICH.,	57 Gratiot Avenue.
TORONTO, CANADA,	138 King Street.
MEXICO, F. Adams' Successors, City of Mexico.	

FACTORIES:

FORT WAYNE, - - - - -	INDIANA.
BROOKLYN, - - - - -	NEW YORK.



SLATTERY INCANDESCENT DYNAMO.

ELECTRICAL ACCUMULATORS.

Useful and Economical for all Purposes to which Electricity is Applicable, such as Propulsion and Lighting of Street Cars, Vehicles, Yachts, Etc.

Central Station and Isolated Lighting,
Portable Lighting or Power,
Portable Electric Lanterns,
Electric Power for Motors,
Portable Electric Fans for Office, Family and Sick Room.

Only Clean and Convenient Battery for Surgeons, Dentists and Professional Men generally.

Manufactured Exclusively under the Patents of

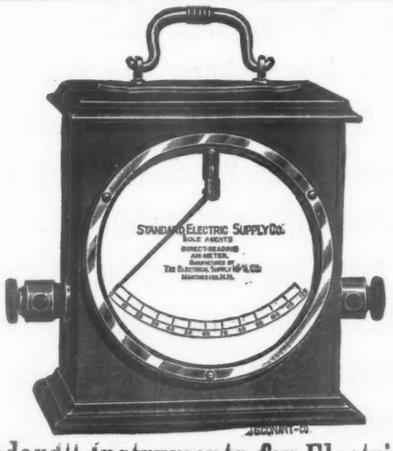
FAURE, SWAN, SELLON, GRISCOM and others.

COMPLETE ELECTRIC LIGHT & POWER PLANTS.

THE ACCUMULATOR COMPANY,

44 BROADWAY, NEW YORK.

PHILADELPHIA AGENCY:
ELECTRO DYNAMIC COMPANY, 224 Carter Street, Philadelphia, Pa.
CHICAGO AGENCY: 239 La Salle St. SAN FRANCISCO AGENCY: 220 Sutter St.
BOSTON AGENCY: HOLTZER-CABOT ELECTRIC COMPANY, 111 Arch St.
PROVIDENCE AGENCY: SWARTS & GANNETT, Swarts Building.



The "Standard" Instruments for Electric Testing.

VOLTMETERS AND AMMETERS FOR
CENTRAL STATION, LABORATORY & BATTERY WORK.

WE GUARANTEE OUR INSTRUMENTS CORRECT, AS EACH INSTRUMENT IS CAREFULLY CALIBRATED BEFORE LEAVING THE LABORATORY, AND WE FURTHER GUARANTEE TO KEEP THEM IN CALIBRATION IF SENT TO US FOR THAT PURPOSE.

TO SUM IT UP.

OUR "STANDARD" VOLTMETERS AND AMMETERS FILL THE LONG FELT WANT FOR A LINE OF INSTRUMENTS COMBINING ACCURACY, BEAUTY AND, MORE ESPECIALLY, REASONABLENESS IN PRICE.

WE SOLICIT YOUR CORRESPONDENCE.

A SPECIAL LINE OF VOLTMETERS FOR RAILWAY WORK AT LOW FIGURES.

PRICES QUOTED ON APPLICATION.

STANDARD ELECTRIC SUPPLY CO.,

180 SUMMER STREET, BOSTON, MASS., SOLE AGENTS.

DETROIT ELECTRICAL WORKS.

The Rae Electric Railway System.

HIGHEST EFFICIENCY

The Only System Employing a Single Motor of Large Horse-Power, with Noiseless Gearing connecting both Axles.

STATIONARY MOTORS OF ALL SIZES.

CORRESPONDENCE SOLICITED —AND— ESTIMATES FURNISHED.

1427 to 1457 WOODWARD AVENUE, DETROIT.

THE

Empire City Electric Co.

15 and 17 DEY STREET,

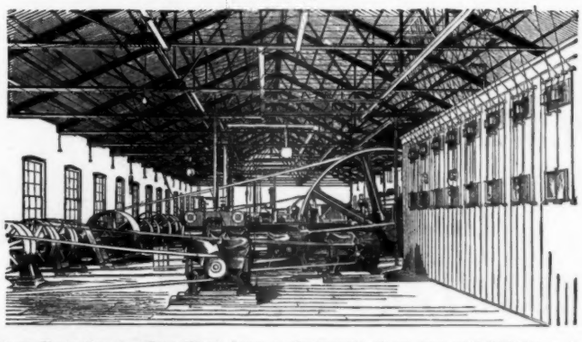
NEW YORK.

Cut-Outs and Rosettes.

Main Line and Branch Blocks.

PRICES ON APPLICATION.

THE BERLIN IRON BRIDGE CO.



The above illustration is taken direct from a photograph of an iron roof built by us for The Waterbury Electric Light Company, at Waterbury, Conn. The side walls are of brick and the roof is of iron, the floor being of asphalt, making one of the most complete and perfect electric light stations to be found anywhere in the United States.

SEND FOR OUR ILLUSTRATED CATALOGUE.

Office and Works: East Berlin, Conn.

AGENCIES:

Wm. Payson, San Antonio, Tex.
W. E. Stearns, Omaha, Neb.
M. B. Grant, Enterprise, Miss.
A. M. Rawn, Dayton, Ohio.

A. B. C. OF ELECTRICITY.

BY WM. H. MEADOWCROFT,

giving, in simple language, a general outline of the science of electricity.

Endorsed by THOS. A. EDISON.

PRICE, 50 CENTS.

108 pages, illustrated, cloth. Sent, postpaid, to any address on receipt of price.

ELECTRICAL REVIEW,

P. O. Box 3329. 13 Park Row, New York.

THE WALKER ELECTRIC METER,

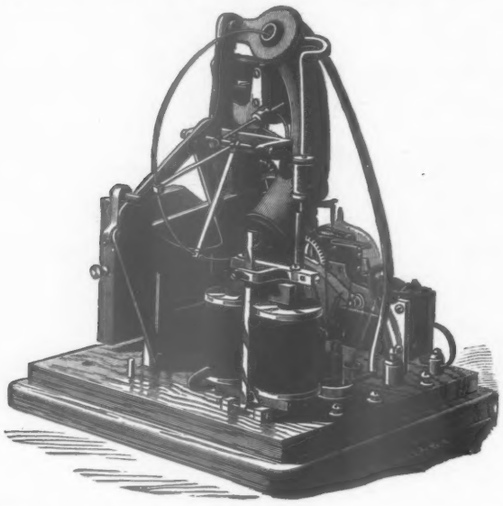
FOR

CONTINUOUS OR ALTERNATING CURRENTS.

ADAPTED TO ANY SYSTEM WITHOUT REGARD TO VOLTAGE.

ACCURATE ON ONE LAMP OR FULL LOAD.

WILL NOT RUN BACKWARDS.



WILL START WITH ONE LAMP.

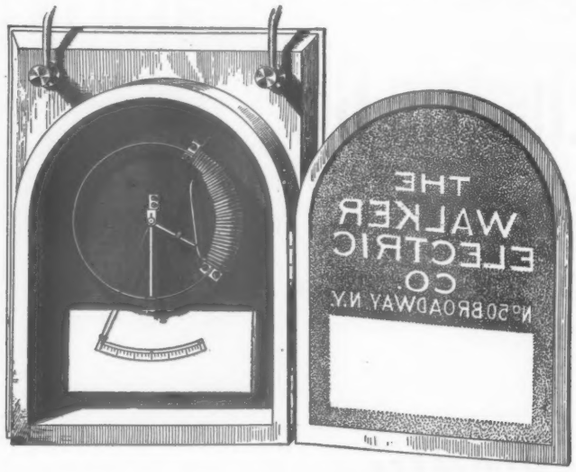
WILL NOT RECORD AFTER LAMPS HAVE BEEN TURNED OFF.

RELIABLE AMMETERS and VOLTMETERS

AT MODERATE COST.

THE FEWEST NUMBER OF PARTS AND OF THE SIMPLEST CHARACTER CONSISTENT WITH ACCURACY AND DURABILITY.

CAN REMAIN IN THE CIRCUIT CONSTANTLY.



DELICACY AND ACCURACY OF OPERATION.

RECORDING VOLTMETERS A SPECIALTY.

SATISFACTION GUARANTEED.

CIRCULARS, LIST OF SIZES AND PRICE LIST FURNISHED ON APPLICATION.

THE WALKER ELECTRIC COMPANY,

50 BROADWAY, NEW YORK.

THE

THOMSON-HOUSTON ELECTRIC CO.

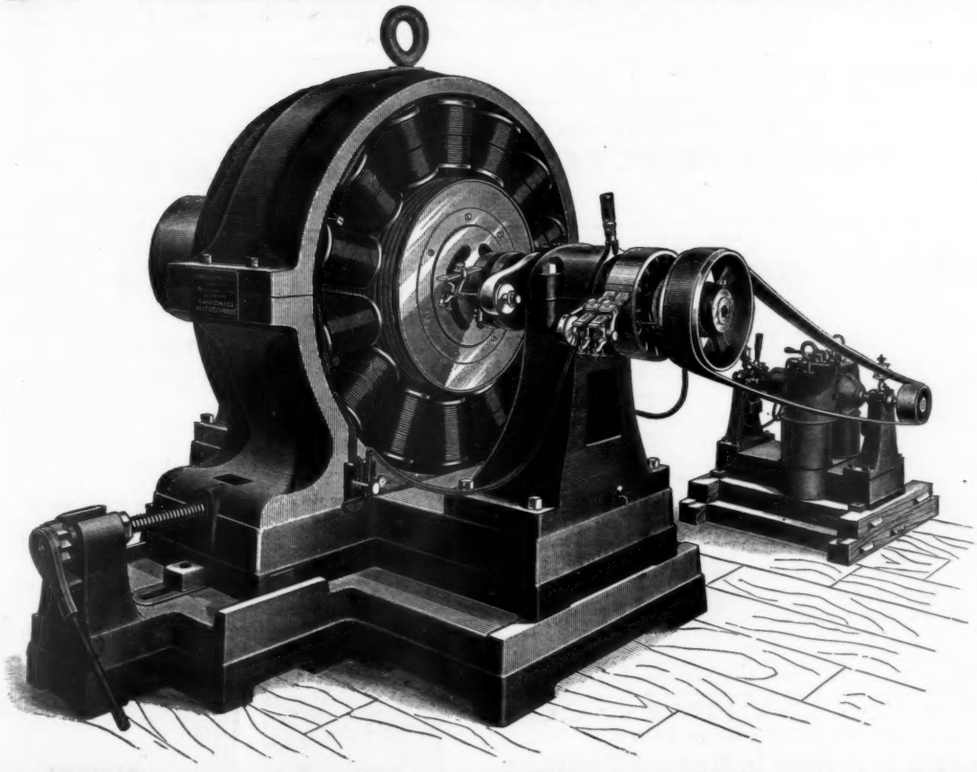
MANUFACTURER OF

DYNAMOS, LAMPS, TRANSFORMERS,

AND ALL NECESSARY APPLIANCES FOR

INCANDESCENT LIGHTING

BY ALTERNATING CURRENT.



After Careful Investigation and Competition the THOMSON-HOUSTON SYSTEM was adopted by the

UNITED STATES GOVERNMENT

For Lighting Officers' Quarters and Public Buildings at the Navy Yard, Mare Island.

For Catalogues and Information, Address,

THOMSON-HOUSTON ELECTRIC CO.,

620 Atlantic Avenue, Boston, Mass.
405 Sibley Street, St. Paul, Minn.
115 Broadway, New York City.
15 First Street, San Francisco, Cal.
266 First Street, Portland, Ore.
831 New York Life Building, Kansas City, Mo.
148 Michigan Avenue, Chicago, Ill.
Wall and Loyd Streets, Atlanta, Ga.
215 West Fourth Street, Cincinnati, O.
1333 F Street, Washington, D. C.
New Kirk Building, Syracuse, N. Y.
509 Arch St., Philadelphia, Pa.

BARNES' PATENT UPRIGHT DRILLS.

20 to 42 inch swing. 4 to 11 h.p. Weight 1,100 to 3,000 lbs. Quick, self feed, and lever feed, self feed and back-geared.

BARNES' Patent Engine Lathes

BARNES' Water Emery Tool Grinder.

These machines have advantages not found in others of this line. It will pay parties desiring to buy machinery to see or know more about them to send for full description and prices to

W. F. & JNO. BARNES CO.
419 Ruby St.
Rockford, Illinois.

DEPARTMENT OF ENGRAVING,
ELECTRICAL REVIEW,
13 PARK ROW NEW YORK.
ELECTRICAL ENGRAVING, A SPECIALTY.
SEND FOR ESTIMATES OF CATALOGUE & ELECTRICAL ENGRAVING, OF EVERY DESCRIPTION.

NEW ELECTRICAL BOOKS.

PRACTICAL ELECTRIC NOTES AND DEFINITIONS.

Designed for the Use of Engineering Students and Practical Men.

BY

W. PERREN MAYCOCK.

TOGETHER WITH

The Rules and Regulations to be observed in Electrical Installation Work.

PRICE, - - - 60 CENTS.

PRACTICAL ELECTRICS.

A UNIVERSAL HANDY BOOK

ON

Everyday Electrical Matters,

INCLUDING

CONNECTIONS, ALARMS, BATTERIES, CELLS, CARBONS, Etc., Etc.

A Convenient Reference Book for those having Electric Bells, Telephones or Electric Lights, in their Houses.

PRICE, - - - 75 CENTS.

EXPERIMENTAL SCIENCE.

BY

GEO. M. HOPKINS.

TREATING THE VARIOUS TOPICS OF PHYSICS IN A POPULAR AND PRACTICAL WAY. IT DESCRIBES THE APPARATUS IN DETAIL AND EXPLAINS EXPERIMENTS IN FULL TO ENABLE STUDENTS TO MAKE APPARATUS WITHOUT MUCH EXPENSE.

PRICE, - - - - $4 00.

MODERN VIEWS OF ELECTRICITY.

BY

OLIVER J. LODGE.

Explaining without Technicalities and Illustrating by Mechanical Models and Analogies, the Position of Thinkers on Electrical Subjects at the Present Time.

PRICE, - - - - $2 00.

Copies of any of the above works sent, postage prepaid, on receipt of price.

ELECTRICAL REVIEW,

P. O. Box 3329. 13 PARK ROW, NEW YORK.

THE TUBES OF THE

INTERIOR CONDUIT AND INSULATION COMPANY

ARE ESPECIALLY APPLICABLE TO

ELECTRIC RAILWAY REQUIREMENTS.

A Simple Solution of the Wiring Problem for Public Buildings, Residences, Factories, Station Work, Cars, Underground Feeders, and all places where insulation is required.

INTERIOR CONDUITS.

Endorsed by the Leading Electricians, Electric Light Companies, Wiring Contractors, Architects, Builders and Boards of Fire Underwriters.

UNDERGROUND CONDUITS

Are equally successful, and afford Cheapness, High Insulation and Durability.

For Catalogue, Price List and General Information, address

INTERIOR CONDUIT AND INSULATION COMPANY,

16 and 18 BROAD STREET. NEW YORK CITY. *EDWARD H. JOHNSON, Prest.*

POND ENGINEERING CO.,

ENGINEERS AND CONTRACTORS.

Complete Steam Plants for Electric Light and Power.

Engines, Boilers, Furnaces, Grates, Heaters, Pumps, Injectors, Pipe Work, Belting, etc., designed with special reference to the HIGHEST EFFICIENCY.

Our Extended Experience Enables us to Guarantee Satisfaction. Send for New Illustrated Pamphlet.

ST. LOUIS, CHICAGO, KANSAS CITY, OMAHA, DALLAS AND SEATTLE.

CHARLES R. VINCENT & CO.,

15 CORTLANDT STREET, NEW YORK,

Ball High Speed Automatic Cut-off Engines

MANNING VERTICAL TUBULAR BOILERS,

Complete Steam Plants Furnished and Erected.

WILLIAMS & POTTER,

15 CORTLANDT ST., NEW YORK.

Engineers & Contractors,

GENERAL AGENTS,

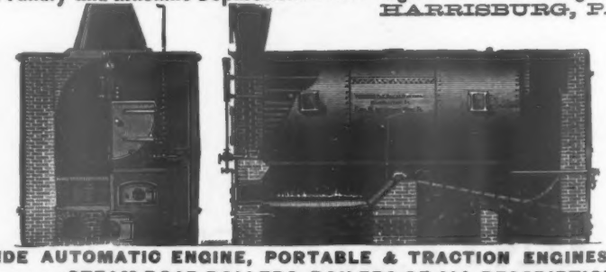
STRAIGHT LINE ENGINES

Weitmyer Patent Furnace,

MANUFACTURED AND SOLD BY

Foundry and Machine Department Harrisburg Car Manufacturing Co.

HARRISBURG, PA.



IDE AUTOMATIC ENGINE, PORTABLE & TRACTION ENGINES.

STEAM ROAD ROLLERS, BOILERS OF ALL DESCRIPTIONS.

New York Office, Messrs. W. R. Fleming & Co., 174 Fulton Street.
New England Office, Messrs. John Post, Jr., & Co., 70 Kilby St., Boston.
Baltimore Office, Messrs. Thomas K. Carey & Bro., 26 Light St., Balt.

WESTERN OFFICE, MESSRS. ENGLISH, MORSE & CO., KANSAS CITY, MO.

JULIEN STORAGE BATTERIES

MANUFACTURED BY

The Consolidated Electric Storage Company,

Exclusive Licensee of the Brush and Julien Storage Battery Patents.

FOR AGENCIES AND LICENSES, ADDRESS THE COMPANY,

120 Broadway, N. Y.

FOR BATTERIES, ADDRESS THE COMPANY,

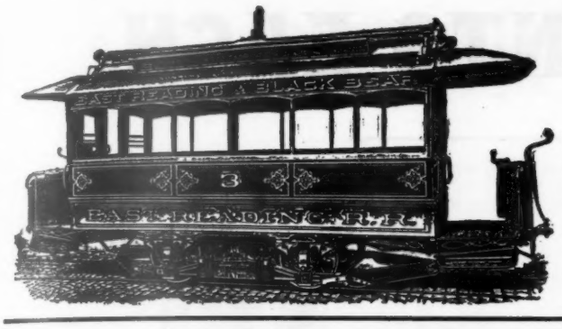
926 Drexel Building, Philadelphia, Pa.

THE NATIONAL CARBON CO.

CLEVELAND, OHIO.

MANUFACTURERS OF

ELECTRIC LIGHT CARBONS AND BATTERY MATERIAL.



JOHN STEPHENSON COMPANY

LIMITED,

NEW YORK.

Street Cars

FOR

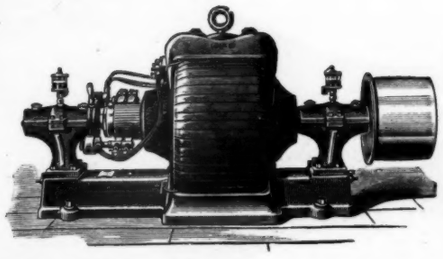
Electric Motors.

"C. & C." ELECTRIC MOTORS.

The only Motors in which the magnetic circuit forms a perfect circle around the centre of the armature shaft. Thus making the most compact and efficient form of machine that can possibly be devised.

One-eighth horse-power to 50 horse-power in stock.

OVER 10 000 MOTORS IN ACTUAL OPERATION.



FAN OUTFITS.

Electric Blowers for Ship Ventilation.

MOTORS FOR HOISTS AND MINING TRAMWAYS.

Equipment of Machine Shops, Printing Offices, Factories and Entire Buildings, with Electric Power.

New England Office, 63 Oliver Street, Boston.
Philadelphia " 38 South Fourth Street.
Chicago " Phenix Building.

"C. & C." ELECTRIC MOTOR COMPANY,

402 & 404 Greenwich Street, New York.

BROWNLEE & CO.,

DETROIT, MICH.

CEDAR POLES

For Electric Purposes.

THE LARGEST STOCK AND QUICKEST SHIPMENTS.

☞ Manufacturers of the Celebrated Octagonal Red Pine Poles for Electric Railways and Electric Lighting; also Manufacturers of Cross-Arms and Pins.

THE WESTON STANDARD

VOLTMETERS AND AMMETERS.

These instruments are the most accurate, reliable and sensitive, portable instrument ever offered. A large variety of ranges to meet the requirements of all kinds of work.

SEND FOR ILLUSTRATED CATALOGUE.

Address,

WESTON ELECTRICAL INSTRUMENT CO.,

Office and Factory 114 & 116 William St., NEWARK, N. J.

"The Electric Railway of To-Day."

— BY —

H. B. PRINDLE,

OF BOSTON.

HANDSOMELY ILLUSTRATED.

THE SUBJECT POPULARLY TREATED.

An Able and Interesting and Timely Publication.

PRICE, 50 CENTS.

ADDRESS:

ELECTRICAL REVIEW,

13 Park Row, New York.

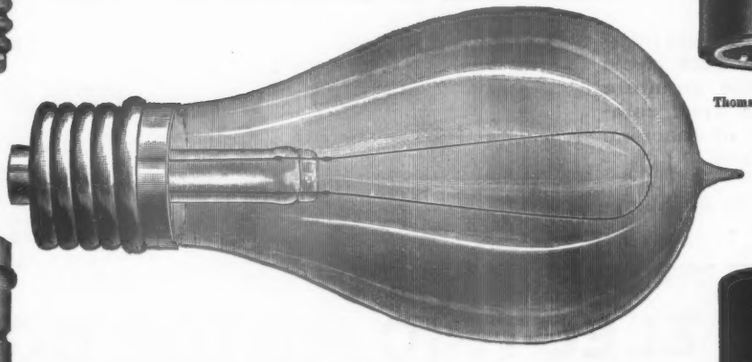
EDISON LAMPS

16 C. P. - 44 CENTS EACH.

16 C. P. Lamps. **12 per Belt H. P.** **600 Hours Average Life.**

No. 1, Edison Base.

The Edison Incandescent Lamp.



No. 2, Thomson-Houston Base.

No. 3, Westinghouse Base.

Unless otherwise specified, all lamps will be shipped with No. 1 bases. The other bases, Nos. 2, 3 and 4 will be placed on lamps, when so ordered, without extra charge.

No. 4, United States Base.

16 C. P. Lamps, List Price, 80 Cents Each.		Net Price.	Discounts for Larger Lots Quoted on Application.
Discount in Lots of 25 to 150,	45 per cent.	44 cents each.	
" " 150 to 500,	47½ "	42 " "	
" " 500 - - - -	50 "	40 " "	

Allowance for Old Bases, $1.35 per 100, f. o. b., Newark, N. J.

DURABLE. EFFICIENT. ECONOMICAL.

Write for Circulars and Price List to Nearest District Office or any Electrical Supply House.

EDISON GENERAL ELECTRIC CO.

MAIN DISTRICT OFFICES:

CANADIAN DISTRICT, BANK OF COMMERCE BUILDING, TORONTO, CAN.
CENTRAL DISTRICT, RIALTO BUILDING, CHICAGO, ILL.
EASTERN DISTRICT, EDISON BUILDING, BROAD STREET, NEW YORK.
NEW ENGLAND DISTRICT, 38 PEARL STREET, BOSTON, MASS.
PACIFIC COAST DISTRICT, EDISON BUILDING, 112 BUSH ST., SAN FRANCISCO, CAL.
PACIFIC NORTHWEST DISTRICT, FLEISCHNER BUILDING, PORTLAND, ORE.
ROCKY MOUNTAIN DISTRICT, MASONIC BUILDING, DENVER, COL.
SOUTHERN DISTRICT, COTTON EXCHANGE BUILDING, NEW ORLEANS, LA.

THOMSON-HOUSTON
ELECTRIC LIGHT CO.

HAVE REMOVED TO THEIR NEW BUILDING,

No. 507 ARCH STREET, PHILADELPHIA.

ARC LIGHTING.

INCANDESCENT LIGHTING.

ELECTRICAL SUPPLIES.

UNITED ELECTRIC TRACTION COMPANY,

EXECUTIVE OFFICES, 115 BROADWAY, NEW YORK.

AGENCIES:

926 Drexel Building, Philadelphia. 111 Water Street, Pittsburgh, Pa. 456 Rookery Building, Chicago.

Electric Railways and Power Stations,

STATIONARY MOTORS, STORAGE BATTERIES.

DYNAMOS, 1 to 250 H. P. MOTORS, ⅛ to 100 H. P.

WORKS, JERSEY CITY, N. J.

GOOD GOODS. PROMPT SHIPMENTS. LOW PRICES.

GATE CITY ELECTRIC COMPANY,

Special Agents,

Manufacturers and Dealers in

Telegraph, Telephone, Electric Light

— AND —

GENERAL ELECTRICAL SUPPLIES.

OKONITE

TRADE MARK

GLOBES AND SHADES,

Glass and Porcelain Insulators

— AND —

Incandescent Lamps.

AND CANDEE WIRES, CABLES, TAPE AND TUBING.

522 DELAWARE STREET, - - - - - - - - KANSAS CITY, MO.

CENTRAL ELECTRIC CO.

General Dealers in

ELECTRICAL SUPPLIES.

GENERAL WESTERN AGENTS FOR

OKONITE

TRADE MARK.

AND

IMPROVED + CANDEE + WIRES.

These Wires are so well known to the Trade that CONVINCING arguments are not necessary. Everybody knows what they are. Send your orders to us when you want the greatest moisture and acid-proof, or the King of Weather-proof Wires.

CENTRAL ELECTRIC CO., 116 & 118 Franklin St., CHICAGO.

CONNECTED BY PRIVATE WIRE WITH POSTAL TELEGRAPH CABLE CO.

CARBON PLATES & CARBON BATTERIES

ELECTRIC LIGHT CARBONS.

MADE FROM NATURAL GAS BY PATENTED PROCESS.

— ADDRESS —

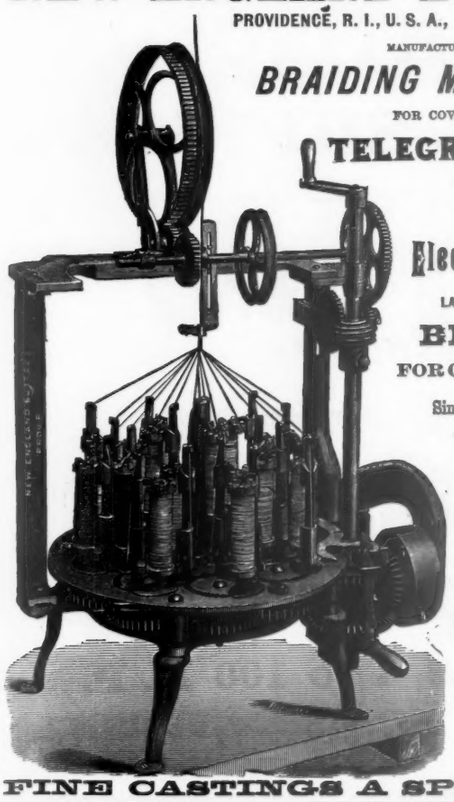
SOLAR CARBON & MANUFACTURING CO.,

95 & 97 FIFTH AVE., PITTSBURGH, PA.

NEW ENGLAND BUTT CO.,

PROVIDENCE, R. I., U. S. A.,

MANUFACTURERS OF



BRAIDING MACHINERY

FOR COVERING

TELEGRAPH, TELEPHONE AND **Electric Light Wire,**

LARGE SINGLE AND DOUBLE

BRAIDERS

FOR COVERING CABLES,

Single, Double and Triple

WINDERS,

Horizontal and Upright

Taping Machines,

Cabling Machines,

Measuring Machines,

Stranding Machines,

Etc., Etc.

FINE CASTINGS A SPECIALTY.

THE RICE AUTOMATIC

GUARANTEED ECONOMY

REGULATION · DURABILITY ·

SIMPLICITY · SELF-CONTAINED ·

8 TO 300 H.P. PAIR & TANDEM · COMPOUNDS ·

THE JOHN T. NOYE MFG CO. BUFFALO. N.Y.

FAIRBANKS, MORSE & CO., Western Representatives, Chicago, St. Louis, Kansas City, Omaha, Denver, St. Paul

ALBERT FISHER, 89 Liberty Street, New York, Eastern Agent.

DO YOUR LAMPS BURN OUT TOO SOON?

YOU BUY THE WRONG KIND!

USE THE

"A. B. C." INCANDESCENT LAMP.

SUPERIOR QUALITY. MODERATE PRICE.

SOCKETS. TRADE A.B.C. MARK SWITCHES.

AMMETERS. CUT-OUTS. VOLTMETERS.

"A. B C." Insulating Tape.

WIRE.

ALEXANDER, BARNEY & CHAPIN,

TELEPHONE BUILDING,

20 Cortlandt Street, NEW YORK.

TO AMERICAN INVENTORS.

Woodhouse & Rawson,

(UNITED, LTD.)

88 QUEEN VICTORIA STREET,

LONDON, ENG.,

New York Office, 36 Wall St.,

Are prepared to negotiate and introduce inventions of merit into Great Britain and all parts of the world.

CORRESPONDENCE INVITED.

SUBSCRIBE NOW ELECTRICAL REVIEW.

MANUFACTURER OF ALL KINDS OF REGISTER SPRINGS FLAT STEEL SPRINGS FOR ELECTRICAL INSTRUMENTS A SPECIALTY

ALANSON CARY

240 & 242 W. 29TH ST. NEW-YORK

THE HOLTZER-CABOT ELECTRIC COMPANY

MANUFACTURERS OF

ALL KINDS OF ELECTRICAL SUPPLIES,

OFFICE:

111 ARCH STREET, BOSTON.

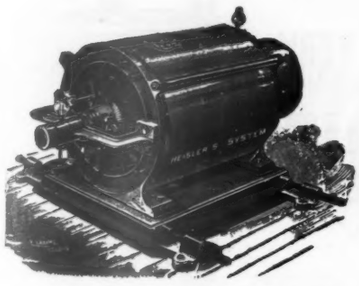
FACTORY:

BROOKLINE, MASS.

HEISLER SYSTEM LONG DISTANCE SERIES INCANDESCENT ELECTRIC LIGHTING

Awarded the Highest Distinction, a Gold Medal, at the Paris Exposition, 1889.

UNEQUALLED FOR DISTRIBUTION OVER WIDE AREAS.



Specially adapted for Street, Commercial and General Illumination from Central Stations. Plant may be located where Power can be secured Cheapest, even if Miles Distant from the Lighting. Safety, Reliability and Financial Success fully Demonstrated. Plan of Wiring the Simplest, Cheapest and Most Efficient. Strictly Series. Lamps, 10 to 100 Candle Power. Long Life without Blackening. Dynamo Self-Contained and Automatic.

SEND FOR CIRCULARS. **CORRESPONDENCE SOLICITED.**

HEISLER ELECTRIC LIGHT CO., Drexel Building, PHILA., PA.

PATENTED NOVEMBER 11, 1888.

The "Special" Gethins Battery,

FOR CHARGING STORAGE CELLS.

Manufactured by the Gethins Electrical Manufacturing Company,

620 ATLANTIC AVENUE, BOSTON, MASS.

Anticipating the unlimited uses to which storage batteries can be applied, the Gethins Electrical Manufacturing Company has perfected and placed on the market a GRAVITY battery which is unsurpassed for the purpose of charging storage cells at a minimum cost, and which involves no trouble in the use of the same, thus enabling any person to handle the battery.

The field for the application of these batteries in connection with storage cells for motive purposes, where powerful chemical batteries or dynamos are impracticable because of expense and labor involved, or distance from an electric plant—is vast. They are already used to operate sewing machines, rotary fans, phonographs, electric pianos and various other appliances, and they can be employed for innumerable purposes in the house, office and factory. A further important and extensive application of the same will be in the furnishing of electricity for running small candle-power lights.

Attention is called to the following testimonial:

BOSTON, Sept. 11, 1890.

B. M. MESERVEY, General Manager Gethins Electrical Manufacturing Co., 620 Atlantic Avenue, Boston, Mass.:

DEAR SIR: Your favor of yesterday at hand. In regard to the battery which we are using, would say that it is doing all the work you claim. We are more than pleased with it, and it is the only "primary" at the present time which we consider satisfactory for such work. We have been using this battery for the past four or five months, and we find that four of the cells connected with a 15 "M" accumulator storage battery will give sufficient power to run our machine with great success. We should advise all persons having occasion to use gravity cells in connection with their storage battery to use yours by all means, as it is surely the most economical and gives the best satisfaction of any which we have ever tried.

We are, yours very truly, NEW ENGLAND PHONOGRAPH CO., by AUG. N. SAMPSON, General Manager.

Price of Battery per cell, ready for shipment.....$1.35 | Price of Battery per cell, with chemicals, ready for shipment.....$1.60

The Gethins Electrical Manufacturing Company is further prepared to furnish the best adapted storage cells and motors to those desiring the complete outfit for motive purposes, and also the most economical and effective storage cells for electric lighting.

SEND FOR OUR CIRCULARS.

Electric Light Fitting.

A Hand-book for Working Electrical Engineers,

EMBODYING PRACTICAL NOTES ON INSTALLATION MANAGEMENT.

By JOHN W. URQUHART.

Chapter I. Central Station Work.
Chapter II. Localizing Dynamo Faults, and Observations Respecting Accumulators.
Chapter III. Switchboard and Testing Work.
Chapter IV. Arc Light Wiring and Fitting.
Chapter V. Wiring for Incandescent Lamps.
Chapter VI. Incandescent Lighting of Ships.
Chapter VII. Miscellaneous Information.

226 PAGES, NUMEROUS ILLUSTRATIONS.

Price, $2.00.

SENT TO ANY ADDRESS ON RECEIPT OF PRICE.

ELECTRICAL REVIEW,

13 Park Row,

P. O. Box 3329. **NEW YORK.**

PRACTICAL WORKS.

BY ROBERT GRIMSHAW, M. E.

ON

STEAM ENGINE, STEAM BOILER, PUMPS, ETC.

STEAM ENGINE CATECHISM.

PART I.....$2.00
PART II.....$1.00

U. S. GOVERNMENT ENDORSEMENT.

NAVY DEPARTMENT, BUREAU OF STEAM ENGINEERING,
WASHINGTON, D. C., Nov. 16, 1888.

I am of the opinion that for the practical instruction of engineers, students and young engineers, they are of great value, besides containing many points of use to those older in the profession.

(Signed) G. W. MELVILLE, *Engineer in Chief, U. S. A.*

STEAM BOILER CATECHISM.

PRICE.....$2.00

The most practical, complete and cheapest work on the subject.

PUMP CATECHISM.

PRICE.....$1.00

One of the most useful manuals for the pump runner and user, containing information that can be had in no other shape or place.

PREPARING FOR INDICATION.

PRICE.....$1.00

Gives complete instruction how to get everything in readiness for indicating an engine, and should be in the hands of every engineer.

ENGINEERS' HOURLY LOG BOOK.

PRICE.....50 Cents.

By the use of this book the engineer's work will be rendered more intelligent and be subject to better supervision.

Copies of any of the above books will be promptly mailed, POSTAGE PREPAID, to any address in the world, on receipt of price. Remit by Express or Post Office Money Order, Postal Note, Draft or Registered Letter.

ADDRESS:

ELECTRICAL REVIEW,

13 PARK ROW, New York.

CROSBY ELECTRIC COMPANY.

PRINCIPAL OFFICE,
87 & 89 SOUTH FIFTH AVENUE, NEW YORK.

CROSBY DRY BATTERIES

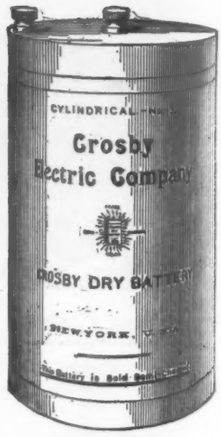
FOR OPEN CIRCUIT WORK.

ELECTRO-MOTIVE FORCE, 1.55 VOLTS. CURRENT, 1 TO 15 AMPERES.

RECTANGULAR, CYLINDRICAL, TELEPHONE.

MADE IN ALL SHAPES AND SIZES.

RECUPERATE OFTENER AND QUICKER THAN ANY OTHER.



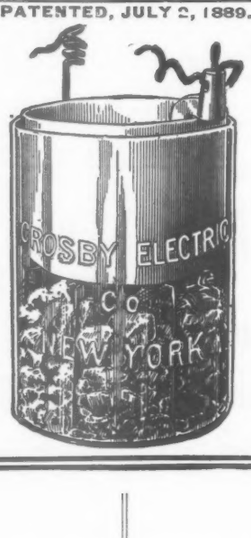
NEAT. = CLEAN. = EFFECTIVE. = SIMPLE. = COMPACT. = PORTABLE.

IT IS THE BEST ON THE MARKET.
IT HAS MORE ADVANTAGES THAN ANY.
IT IS SOLD SEMI-CHARGED.
IT DOES NOT DIE ON THE SHELF.
IT IS NOT AFFECTED BY TEMPERATURE.
IT IS NOT DESTROYED BY SHORT CIRCUIT.
IT IS THE MOST RELIABLE.
IT PERFORMS THE MOST WORK.

FOR TELEPHONES, ANNUNCIATORS, GAS LIGHTING, HOUSEWORK, MEDICAL PURPOSES.

PATENTED, JULY 2, 1889.

THE HUSSEY BLUE STONE.



The Only Blue Stone Battery that can be used for open circuit work.

No Consumption of Blue Stone when not in use.

For Charging Storage Batteries, Running Sewing Machines, Small Incandescent Lamps, Fans, Dental Machines, Telegraphing.

Can be completely recharged without dismounting.

No Deposit of Copper on Zinc.

Gives 10 Times the Current of Any.

For Running Motors.

For All Uses.

THIS IMPROVEMENT CAN BE APPLIED TO ALL FORMS OF BLUE STONE JARS AT PRESENT IN USE.

THE DUPLEX.

Its two cells occupy only the space of one, thereby giving a voltage in the space of one cell, equal to that obtained by any other two cells requiring double the space.

**For Housework,
Bells,
Burglar Alarms,
Etc.**

No Climbing Salts.

Always Clean.

Recuperates Quickly.

Large Zinc Surface.

Is rapidly taking the place of all other Open Circuit Liquid Batteries.

THE ECLIPSE.

**Intended for Close Circuit Work.
Will Not Polarize.
Pure Water only Necessary to Charge It.
The Simplest and Cleanest Close Circuit Battery in the World.**

No Fumes.

No Odor.

For Small Motors.

Small Lamps.

For Doctors' and Dentists' Use.

Induction Coils, Etc., and all purposes where a Constant Current is required for continuous or intermittent work.